GAS JOURNAL

LIGHT . HEAT . POWER . BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

Vol. 203. 85th Year. LONDON, AUGUST 23, 1933. No. 3666. Price 1s.

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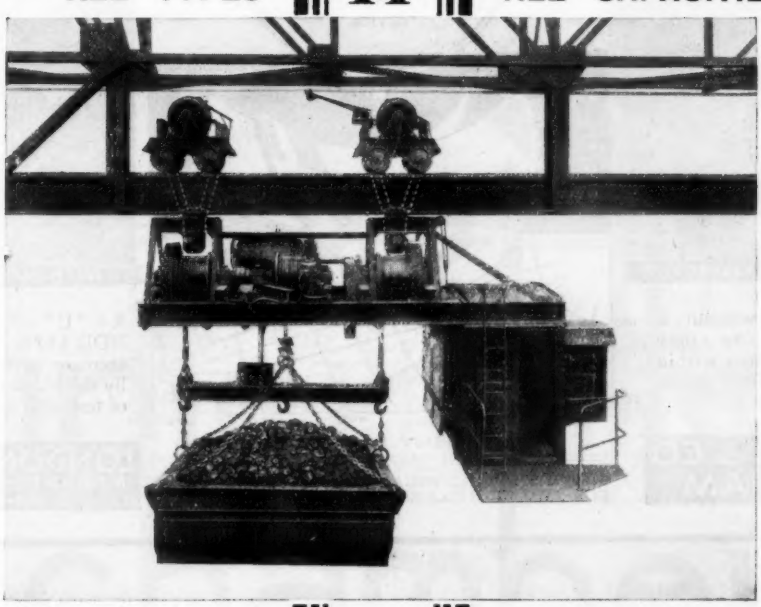

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The Meter that may be used :—

1. For PENNIES AND SHILLINGS.
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The consumer has a FREE CHOICE of using either pennies or shillings. No alteration to meter mechanism is involved. Either coin can be inserted at will and the appropriate volume of gas delivered. "Chelsea Two" Meters can be easily restricted, if required, to take PENNIES ONLY or SHILLINGS ONLY. No other gas meter offers all three advantages.

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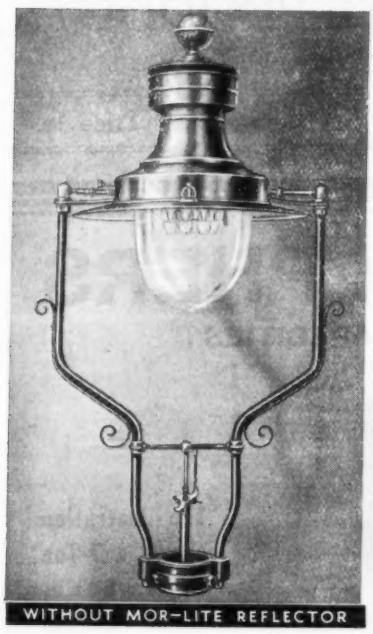
INCREASES THE ILLUMINATION OF "U"-FIXING LAMPS BY 200%



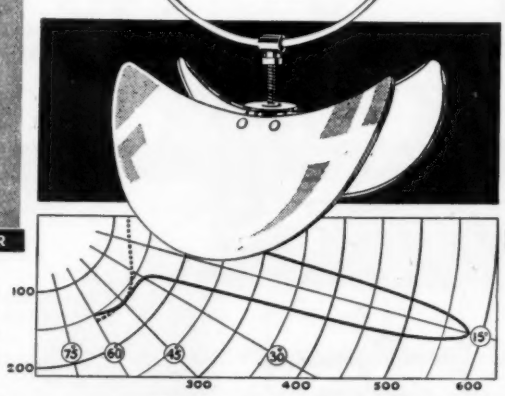
WITHOUT MOR-LITE REFLECTOR

A "U"-fixing lamp, without a MOR-LITE Reflector can only illuminate the smaller area within the dotted line shown on the graph chart

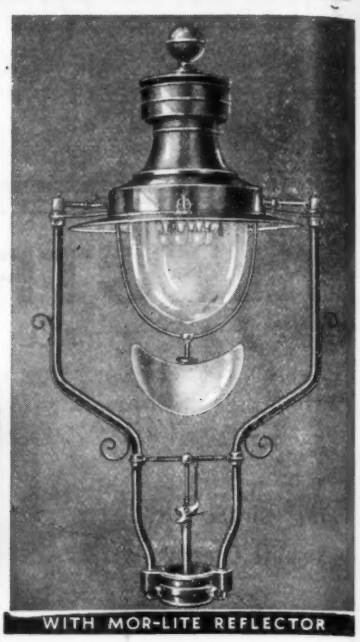
"PARKINSON"

MOR-LITE

Here is a new MOR-LITE REFLECTOR which increases the illumination of "U"-fixing street lamps by 200% without increasing the cost of gas. The harp fitting is almost invisible and the wings are of highly polished STAYBRITE steel with adjustable clip and locking device.



....WITHOUT MOR-LITE REFLECTOR
————WITH MOR-LITE REFLECTOR. . .
GRAPH SHOWING POLAR CURVE COMPARISONS FOR TWO LIGHT LAMP



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A "U"-fixing lamp with a MOR-LITE Reflector gives 200% increase in illumination as shown by the black line on the graph chart of test, and without extra cost.

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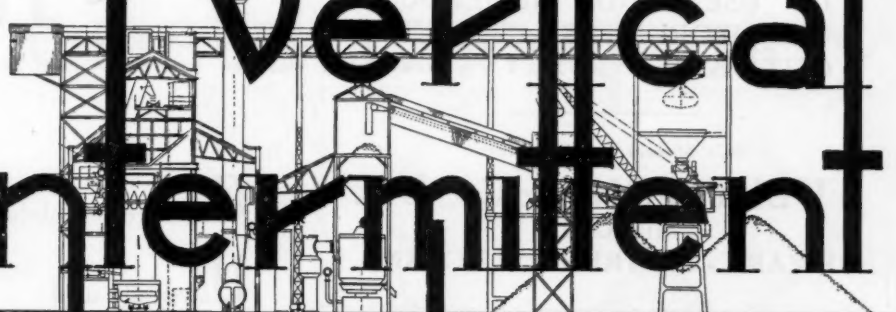

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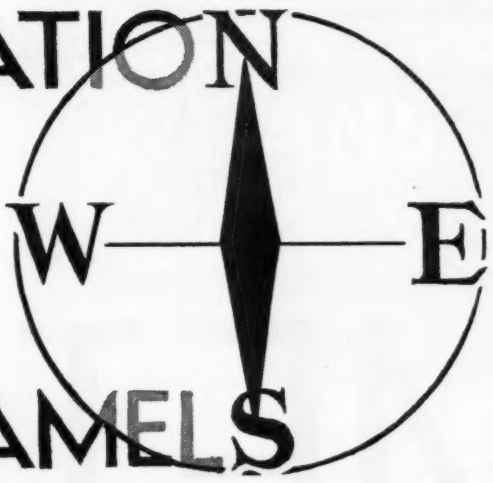

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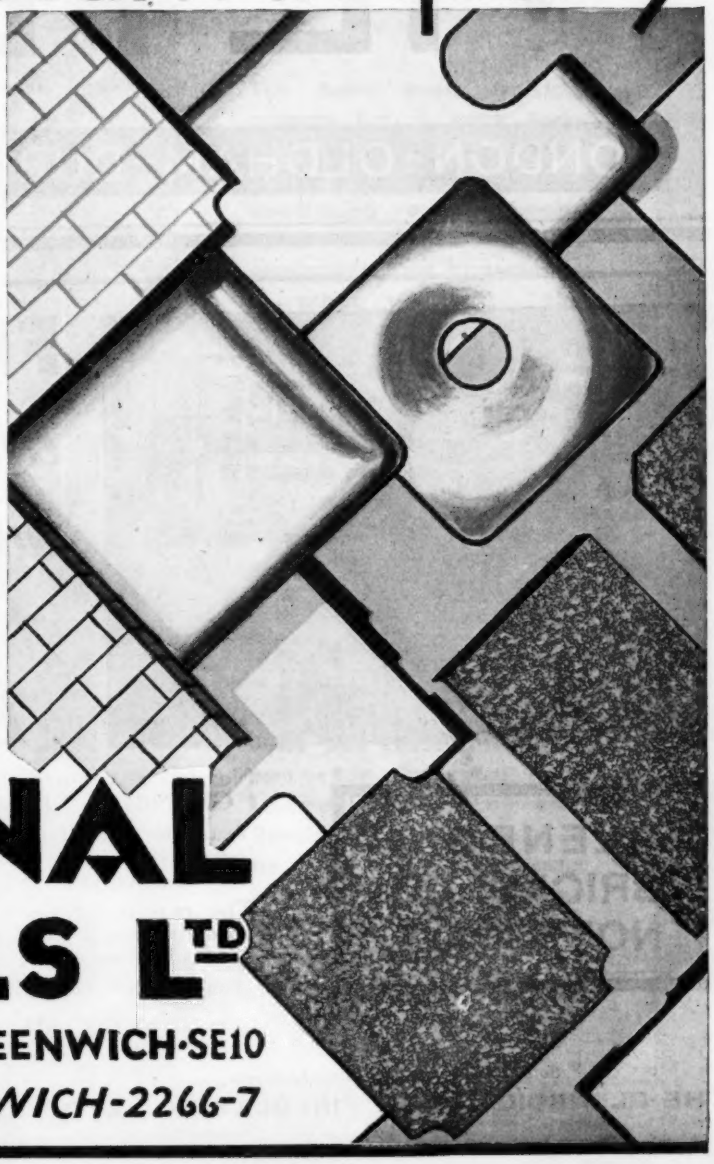

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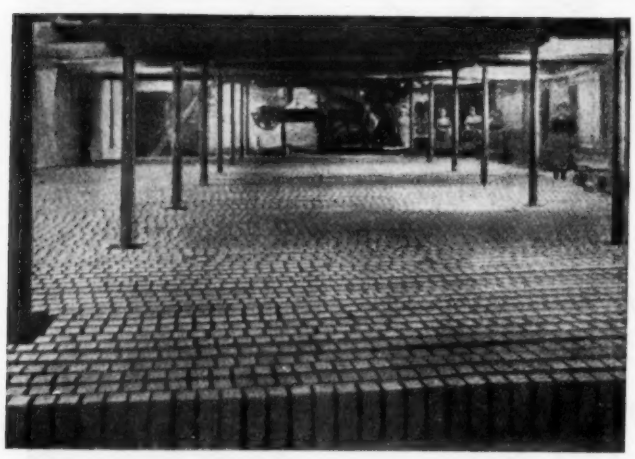

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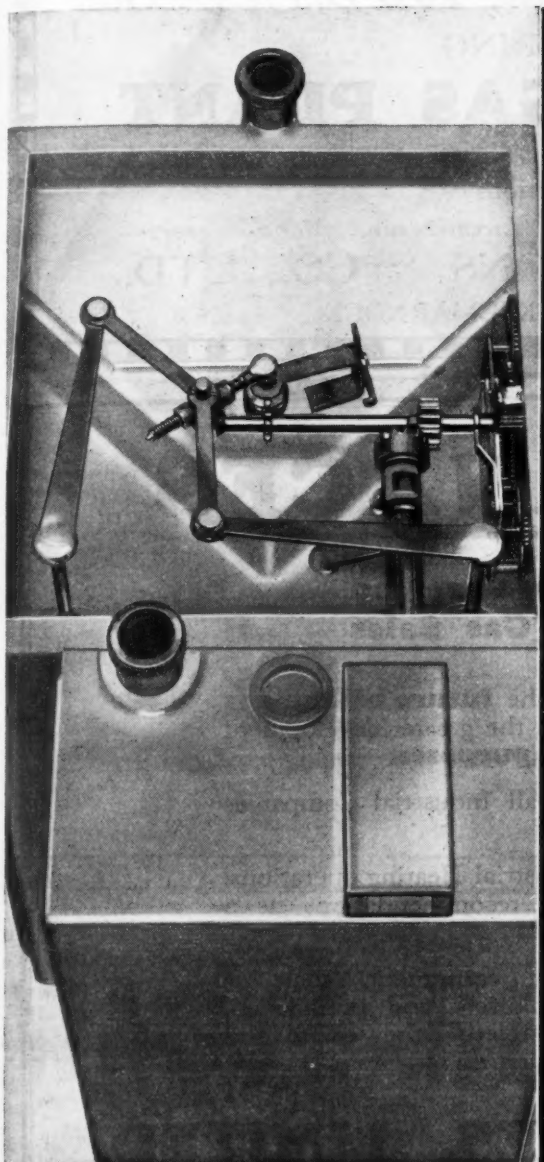

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"..... we propose to offer our reasons...."

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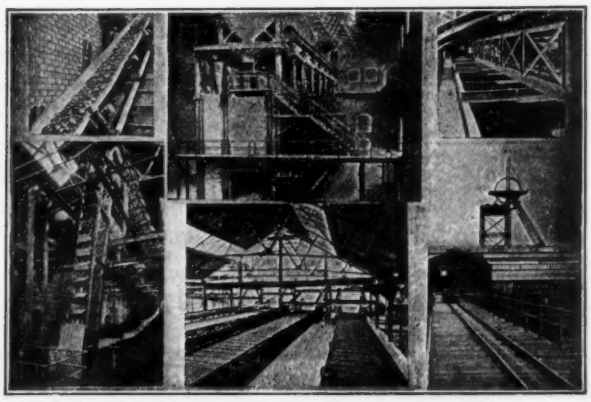

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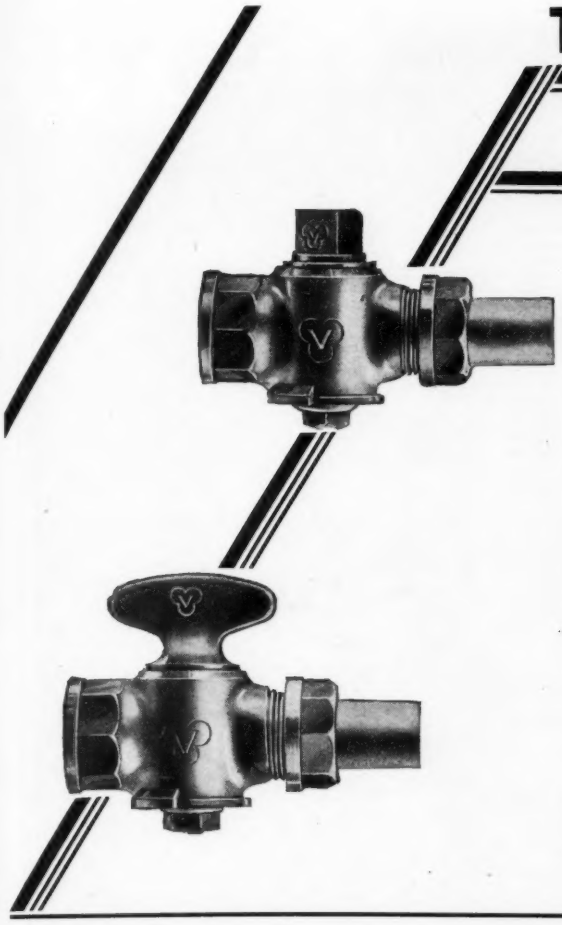

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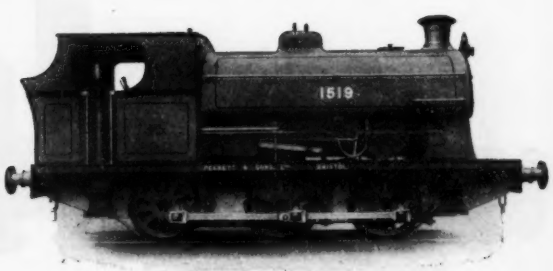

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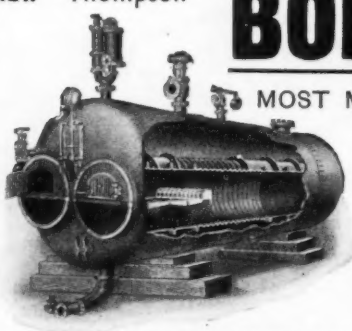

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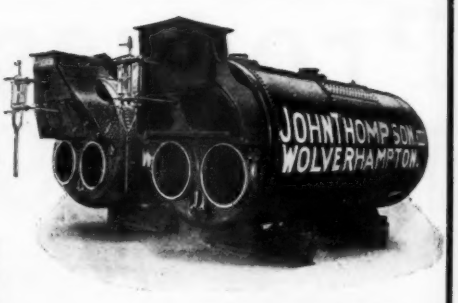

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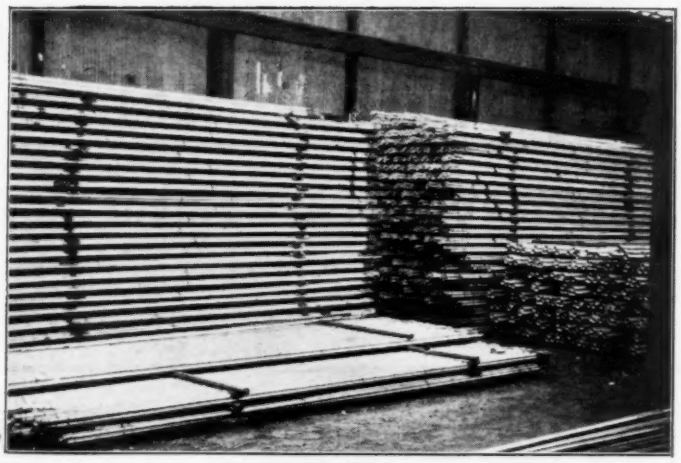

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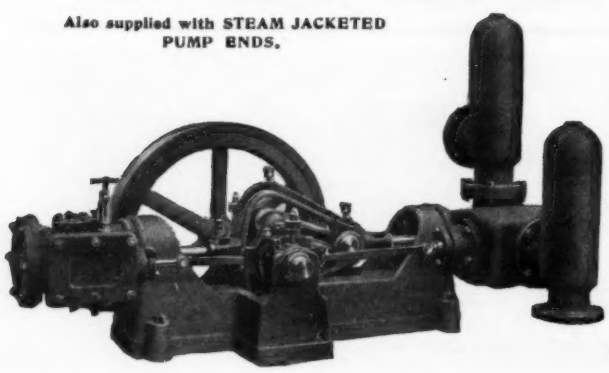

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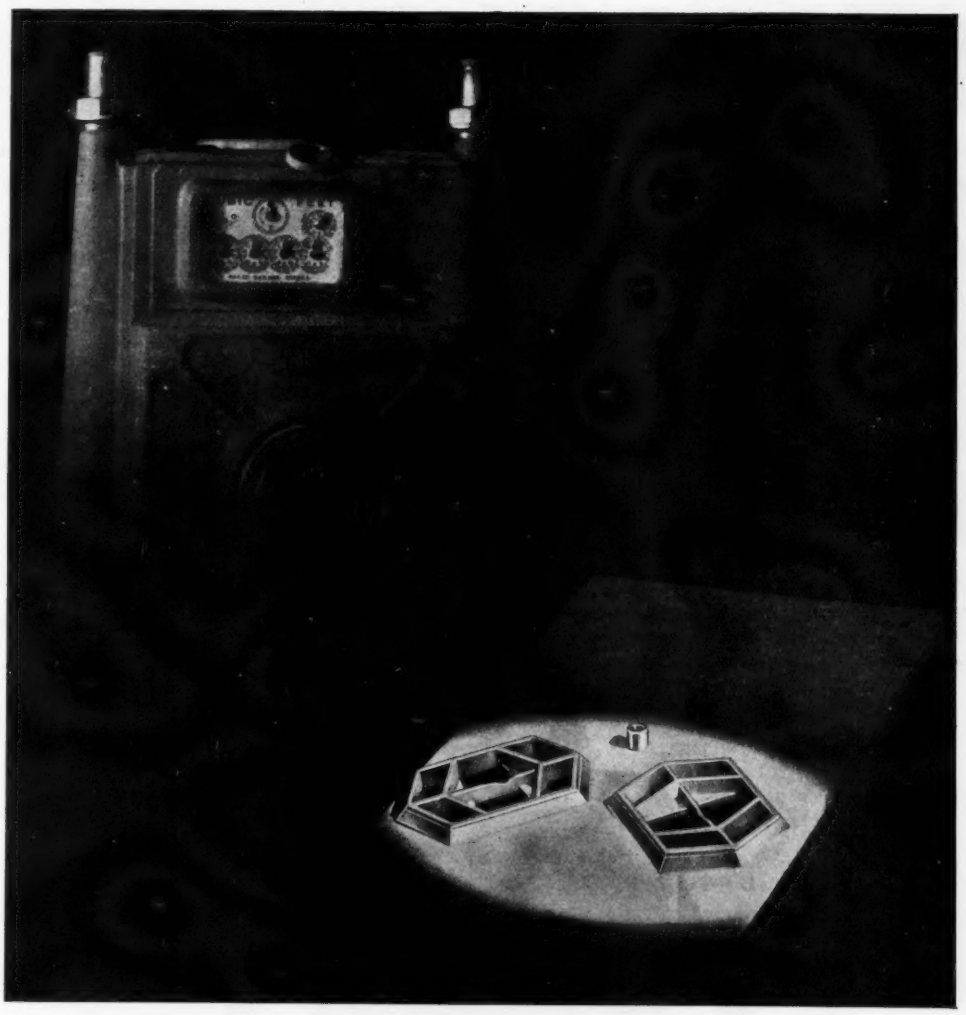

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Works under its own power. May be used as a Concrete Breaker or Light Pile Driver. 50/60 Blows per minute. Working Costs, including Labour, Fuel, Depreciation, etc., under 2½d. per cu. yard **One man keeps 6 men busy shovelling.**

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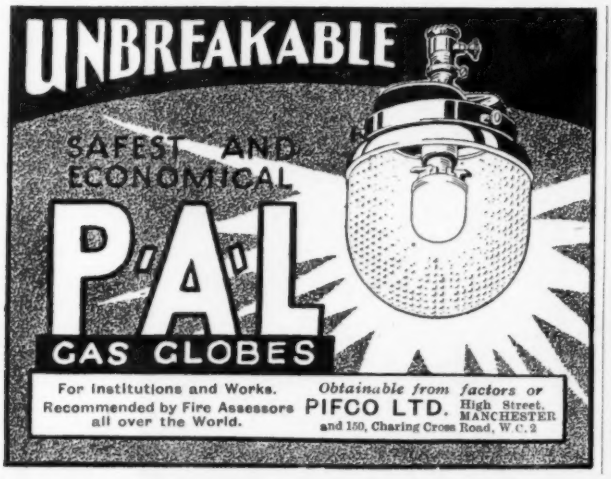

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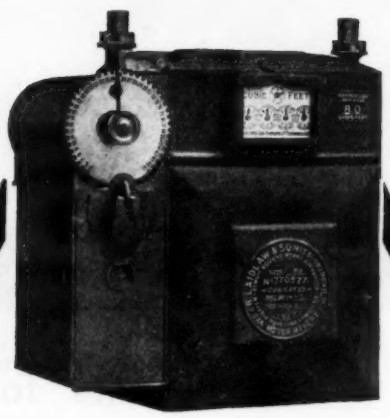

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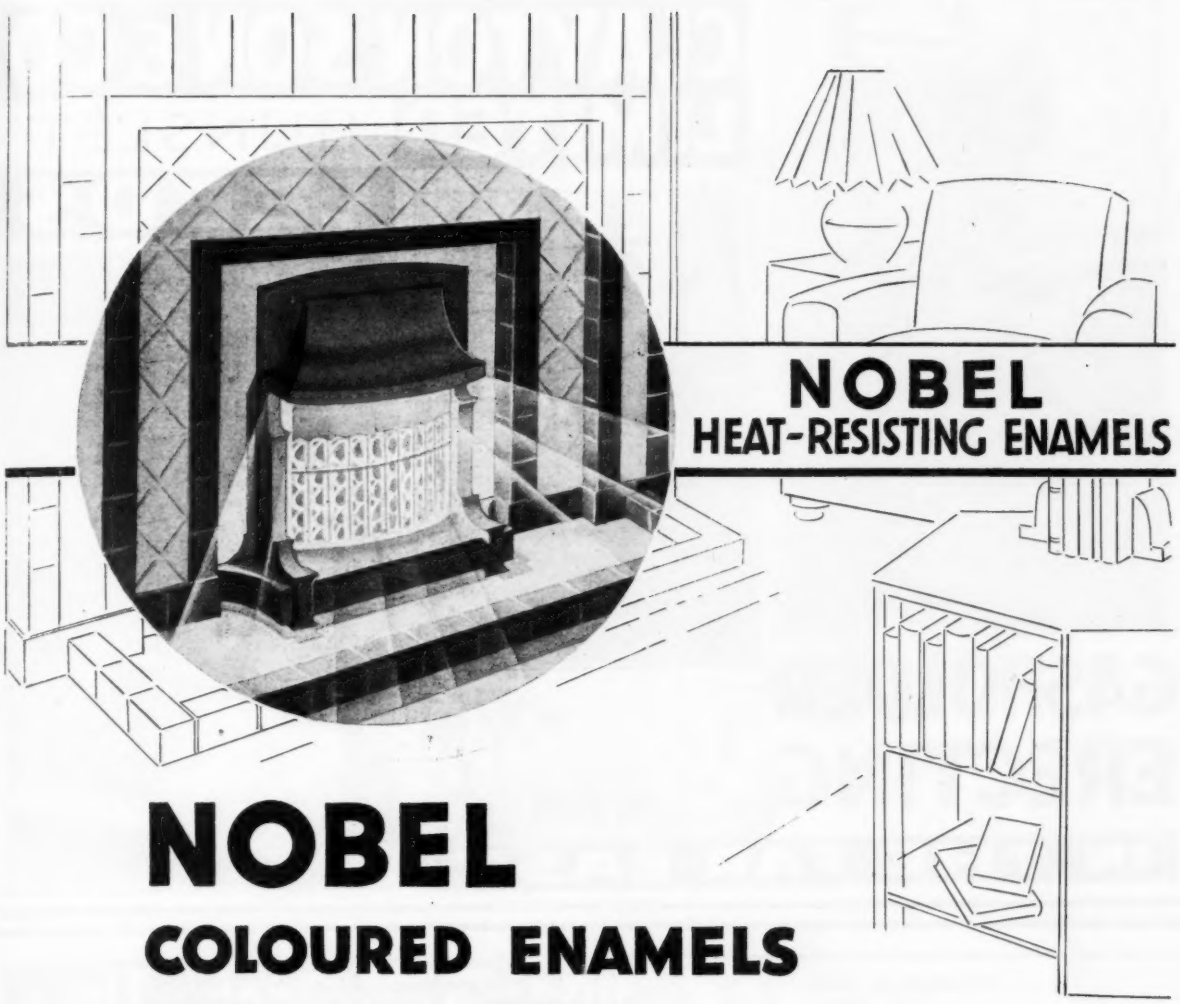

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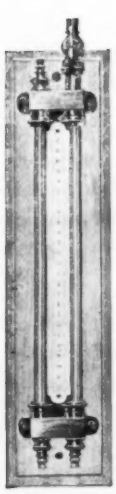

Pressure Gauge.

Copper Syphon Pump.

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ORDINARY and PREPAYMENT.
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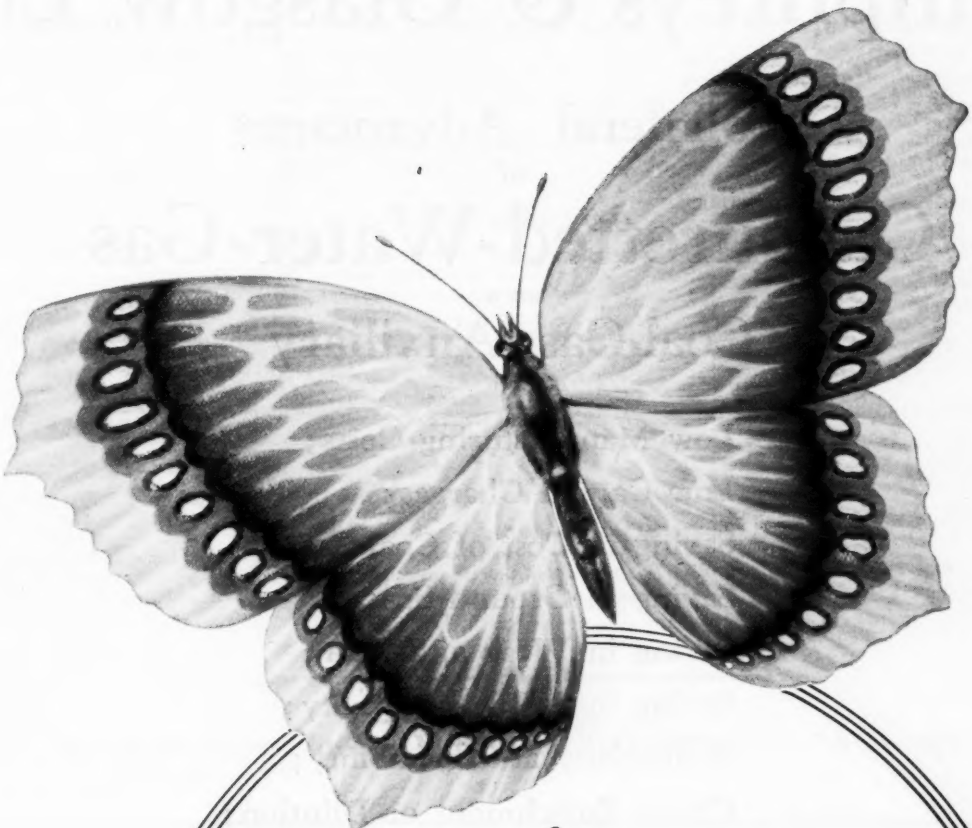

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Independence of Gas-Coal;
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GOOD REASONS for these Canopies

Aluminium canopy installed over a gas cooker in a hospital. (By courtesy of Fletcher, Russell, & Co., Ltd.)

"In institutions, restaurants and similar places where a considerable amount of cooking is undertaken, a canopy is sometimes mounted over the cookers and hotplates. Aluminium has been shown to be a suitable medium for these constructions since it is reasonably cheap, light, easily worked and easily cleaned, and canopies are now usually constructed of aluminium sheet and angle. One of the corollaries of its use is that a much lighter supporting structure is required with aluminium than if heavier metals are used. In cases where it is not possible to make the complete canopy of aluminium because of lighting and visibility difficulties, it is common practice to use aluminium alloy angle framework with glass panelling."

★ ***An extract from B A. Co., Data Book No. 354, "Aluminium in the Gas Industry" (sent free on request).***

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THE GAS JOURNAL

AUGUST 23, 1933

Vol. 203. 85th Year No. 3666

A Glance at the Contents—

Another Gasholder " Grouse."

The *Yorkshire Post* is not fond of gasholders. [p. 410.]

Retail Sales Manager Required.

Applications are invited for the position of a Retail Sales Manager to a Corporation Gas Undertaking. [p. 416.]

Scottish Undertaking Wants Junior Assistant.

A Scottish Gas Undertaking making approximately 600 million c.ft. per annum requires a Junior Works Assistant. [p. 416.]

Post of Assistant Gas Engineer Vacant.

Applications are invited by a Gas Company near London for the position of Chief Assistant Gas Engineer. The salary offered is £500 per annum. [p. 416.]

Coke Oven Gas for Glasgow.

The suggestion that Messrs. Wm. Baird & Co. should supply coke oven gas to the Glasgow Corporation was considered by the Works and Distribution Committee of the Gas Department last week. [p. 393.]

Irish Association.

A report of the Annual Meeting of the Irish Association of Gas Managers, which was held at Waterford under the Presidency of Mr. F. J. Edmonds, Manager of the City of Waterford Gas Company, commences on p. 400.

Vertical Retorts for Ireland.

In his paper on this subject before the Irish Association of Gas Managers, Mr. A. Law, of Limerick, says that the continuous vertical retort has proved that it is susceptible to modification in design to deal with whatever changes may be necessary to adapt it to different requirements. [p. 403.]

The Bergin Process.

An explanation is given of how, just over twelve years ago, Dr. Bergius's process for obtaining oil from coal was brought to the notice of the British Government. [p. 408.]

Automatic Combustion Control.

An ingenious device for automatically maintaining the correct ratio of secondary to primary air supplied to producer-gas fired settings of horizontal retorts is described on p. 398.

Success of Sliding-Scale Charges.

The popularity of the sliding-scale method of charging for gas has largely helped to make possible the increase of 23% in gas sales experienced in the 14 years' period this system has operated in Greenock. [p. 392.]

Visit to Canada and the United States.

A list of members of the French Gas Industry who, under the leadership of M. A. Baril, will attend the forthcoming conventions of the Canadian Gas Association and the American Gas Association is published on p. 392.

Carburetted Water Gas.

The first part of a fascinating study of the financial benefits of carburetted water gas to the Gas Industry of Great Britain is published in our columns to-day. It is a challenging article written in a most readable manner. [p. 394.]

Tar Firing of Retorts.

In a paper before the Irish Association Mr. J. W. Young, of Queenstown, maintains that tar firing of retort settings is a thing to be seriously considered, " more especially by the management of a small works, since having an interchangeable coke and tar fired setting will enable those responsible to meet effectively the sudden rush of coke which occurs at times." [p. 406.]

Forthcoming Engagements

Sept. 4-7.—ASSOCIATION OF PUBLIC LIGHTING ENGINEERS.—Tenth Annual Meeting and Conference at Margate.

Sept. 5.—S.B.G.I.—Meeting of Council, 2.30 p.m.

Sept. 7.—NORTH BRITISH ASSOCIATION.—Annual Meeting in Paisley.

Sept. 7.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (WESTERN DISTRICT).—Commercial Meeting at Exeter.

Sept. 12.—NATIONAL GAS COUNCIL CENTRAL EXECUTIVE BOARD. There will be no meeting of the Board during the month of August.

Sept. 21.—WALES AND MONMOUTHSHIRE ASSOCIATION.—Meeting at Porthcawl.

Sept. 25-27.—B.C.G.A.—Annual Conference at Bournemouth.

Nov. 7-8.—I.G.E.—Autumn Research Meeting.

Nov. 9.—S.B.G.I.—Autumn General Meeting, Hotel Metropole, London.

EDITORIAL NOTES

Carburetted Water Gas

THE first part of a fascinating study of the financial benefits of carburetted water gas to the Gas Industry of Great Britain is published in our columns to-day. It is a challenging article written in a most readable manner; and the fact that it is contributed by Messrs. Humphreys & Glasgow is alone sufficient to command respect. The story is certain to excite the interest of all our readers, and it comes at a time when it might be thought that the imposition of a Customs Duty of a penny a gallon on imported oil will seriously affect the economics of carburetted water gas manufacture in relation to the cost of making coal gas alone. Of course, the Duty has its effect, but how small this effect is will be seen from the analysis of the whole question made by the authors.

There is nothing ambiguous about the contribution. It is a straightforward statement, backed by convincing argument; and with gas-oil taken at 4d. per gallon, which price includes the new Duty, an "overwhelming case" is made out for carburetted water gas as a coal gas auxiliary. It is stated categorically that "including works capital charges, peak load carburetted water gas costs only three-fifths of the cost of peak load coal gas for the same service." Again, "even if the manufacturing cost of the carburetted water gas were higher—unprecedentedly higher—than that of coal gas, a mixture of the two in suitable proportions would be cheaper, and far cheaper, than the coal gas alone." It is a matter of strategic co-partnership.

Part I. of the contribution is concerned with the direct savings realized by the use of carburetted water gas instead of coal gas for peak load service. For the purpose, the annual production of gas is divided into two portions. The first—the base-load portion—represents conditions favourable to high coal gas economy; the second, the peak load portion, embraces all especially adverse coal gas conditions, and is utilized to compare coal gas with carburetted water gas for peak load service. This is a perfectly legitimate basis of comparison, for the peak load portion should be debited with the extra fuel, labour, wear and tear, and so on, required to keep ready for prompt gas-making the plant needed not only for normal seasonal variations in demand, but for emergency service; and it involves greatly increased capital charges per unit of output.

On the figures taken for comparison, figures which will be critically examined, the following main conclusions are reached: (1) Including capital charges, peak load carburetted water gas costs 3·99d. per therm, while peak load coal gas for similar duty costs 6·53d. per therm. (2) Including capital charges, base load coal gas made jointly with peak load carburetted water gas (20% of annual output in the peak load portion and 41% of carburetted water gas in the maximum day's output) costs 3·37d. per therm. In other words, this joint working reduces the cost of peak load gas by approximately one-half. (3) Including capital charges, coal gas costing 4d. per therm divides into base load gas at 3·37d. per therm and peak load gas at 6·53d. per therm; and hence carburetted water gas can be profitably used for peak load service (to the extent of 41% of the maximum daily output) up to the cost of 6·53d. per therm. The final conclusion is that the peak load portion allotted to carburetted water gas should be far greater than 20%.

Messrs. Humphreys & Glasgow would be the last to talk irresponsibly on this most important problem; and their startling contribution on gas manufacturing policy will cause more than a flutter in gas engineering circles. Next week we shall be publishing the Second and Third Parts of the contribution, when opportunity will be taken to comment on the arguments advanced.

The Irish Meeting

THERE was only one opinion about the Annual Meeting of the Irish Association of Gas Managers which was held last week in Waterford—that it was a success in every way. The President, Alderman F. J. Edmonds, and the Hon. Secretary, Mr. George Airth, made arrangements for the proceedings which worked with the utmost smoothness in every respect; while the hospitality of the City of Waterford Gas Company was "real Irish." Sir Stanley Harrington, the Deputy-Chairman of the Company, was, indeed, quite "a host in himself."

During the day a good attendance was registered, while the dinner in the evening, and the dance afterwards, will be long remembered by everyone present. And this memory should be both pleasurable and serious; for between the joys of the table and the joys of the dance-floor there came a sound exhortation from the President of the Institution. Mr. Tarratt's exhortation was, in effect, to banish pessimism, and go out to get the business which lies around. These are dull times, and business is admittedly not easy to get, but Mr. Tarratt believes that it is there for the right men who seek it in the right way. That is to say, there is business for those who search for it, armed with faith in the Industry and an attractive tariff schedule. Railing at electricity, which has become a "permanent neighbour," will not get anyone anywhere; but faith and suitable tariffs should carry one a long way.

Scattered Districts

As noted in the "JOURNAL" last week, the Belfast Corporation Gas Department has received orders for a large and regular supply of compressed gas in bottles for the Great Northern Railway, for use in their restaurant cars. This contract is of great importance on account not of the quantity of gas so sold, but of the nature of the load and the possibilities which it opens up to the Gas Industry in Ireland. This topical question of selling bottled gas is referred to by Mr. A. Law, Engineer and Manager to the Limerick Gas Undertaking, in his paper before the Irish Association of Gas Managers, published in the "JOURNAL" to-day. Gas distribution in a sparsely populated country like Ireland presents peculiar difficulties—difficulties which, however, may well be solved by the sale of gas in bottles. The application of this system to the supply of outlying houses, farms, and villages should be seriously considered. In Mr. Law's words, "the cost of the cylinders and of compression is not greater than that of consumers' meters, services, and maintenance, while the cost of carriage can be set against boosting costs and capital charges on long-distance mains."

The paper by Mr. Law is concerned with continuous vertical retorts, which system of carbonization he considers, with good reason, particularly applicable to Ireland. The vertical retort could have no supporter stauncher than Mr. Law, whose contribution is a panegyric upon this method of making gas. The continuous vertical retort, he says, has proved that it is susceptible to modification in design to deal with whatever changes may be necessary to adapt it to differing

requirements. Whether the demand be for maximum gas output, for gas of low or high calorific value, for maximum or minimum coke production, for tars suitable for road making, or other purposes, the vertical retort is the plant for works both large and small. He suggests that it is not generally realized how readily and how perfectly the continuous vertical retort can be adjusted to meet all classes of coal. His own undertaking, in common with many other undertakings in Ireland, has been obliged to turn from British to Continental coal. Yet " the change-over has been effected without the slightest trouble or inconvenience, and without the slightest interruption in the production of gas at the declared calorific value."

Mr. Law cites as one of the greatest advantages of the vertical retort the ease with which it can be slowed down and speeded up. He remarks that he has known instances where holder capacity is small and where difficult situations have been satisfactorily dealt with " solely because the output of the vertical retort can be reduced to one-half its normal capacity within a few hours, and increased beyond it with equal facility, by very simple mechanical manipulation. And this can be done without detriment to the constant quality of gas produced and without any ill effect on the bye-products." To show the effect of the installation of vertical retorts he sets out a comparison of the principal working results of the Limerick Gas Undertaking in 1924, with horizontals, and in 1932-33 with verticals. Labour costs have been reduced by more than half, and the figures for works maintenance for 1924 and 1932-33 are £3120 and £1293 respectively. " Works maintenance " includes an annual sum of £140 laid aside for re-setting. Actually, no more than £431 has been expended on repairs and maintenance of the vertical retort installation and its ancillary coal and coke handling plant during its six years' working—which is equivalent to less than 2¼d. per ton of coal carbonized. Mr. Law certainly leaves no one in doubt regarding which type of carbonizing plant appeals to him.

Uniform Gas Quality

A GRATIFYING feature of the meeting of the Irish Association was the coming-forward of one of the younger members, Mr. J. W. Young, of Queenstown, with a paper bearing a very long title, but the contents of which are very much to the point. Nothing is more important in giving good service than the supply of gas of uniform quality; and it must be admitted that the smaller works find this desideratum more difficult of attainment than do the larger ones. At the same time, by the exercise of closer control—not necessarily expensive control—the small undertaking can ensure that the gas delivered from the works into the town mains is constant in quality within quite a narrow margin of error. Mr. Young shows what improvements can be effected by taking care over the details of carbonization. He devotes attention to practical and simple means of ensuring a non-varying gas into holder—a matter of particular concern to those works where ample storage facilities are not available and where the inlet and outlet pipes in the holder are close together. The device he describes and illustrates in his paper for minimizing time lag in the indication of change of quality of the gas at the outlet of the purifiers is of great interest, and the smaller works could experiment to good purpose with the device in either its present or some modified form. Again, his comments on light seals and no seals at all are of much value.

Where, as is often the case in the smaller works—and in some big ones, for that matter—producer gas is used as a diluent of the straight coal gas, it is axiomatic that the percentage of producer gas added should not vary, and also that the quality of the producer gas should be constant. On this matter, too, Mr. Young has useful information to impart. Especial interest attaches to the author's comments on the tar firing of retorts—a question discussed by his Chief, Mr. W. E. Young, of Queenstown, at the meeting of the Association in Londonderry a couple of years ago. At that meeting Mr. Young made the point that, for firing settings, 100 gallons of tar liberated for sale 1 ton of coke. The present author explains that during the past two years strides have been made in the technique of tar firing. With a steam injector, coke at 31s. a ton made the value of tar 3·2d. per gallon; and by the application of a new type of fan for air-blast injection the tar figure is likely to be somewhat reduced. Mr. J. W. Young, concluding his paper, maintains that tar firing of retort settings is a thing to be seriously considered, " more especially by the management of a small works, since having an interchangeable coke and tar fired setting will enable those responsible to meet effectively the sudden rush for coke which occurs at times." It must be added, though, that 31s. a ton is a high price at which to debit the grade of coke which can now be efficiently utilized in producers.

Firing of Settings

AN ingenious device for automatically maintaining the correct ratio of secondary to primary air supplied to producer-gas fired settings of horizontal retorts is described in our columns to-day. It is pointed out that fluctuations in this ratio are caused by changes in the resistance of the fuel bed in the producer due to clinker formation, consumption of coke, and charging; each change in the primary air gives rise to a variation in the secondary air, and combustion conditions oscillate periodically between excess of gas and excess of air—which reacts unfavourably on the throughput and temperature of the setting. The device, which is exceedingly simple, does not complicate the operation of the setting, which is controlled in the usual manner—*i.e.*, the hand-operated primary air damper is adjusted so that the secondary air ensures complete combustion of the producer gas. The regulator then maintains the ratio of primary to secondary air. As a result, it is claimed, considerable fuel economies are effected, general carbonizing conditions are under closer control, temperatures of the setting are more constant, and minimum draught is required. The device is certainly worthy of attention.

Co-Operative Action Needed

REFERRING to the achievements of the recent session of the World Economic Conference, which " must, frankly, be regarded as disappointing," the August issue of the *Westminster Bank Review* urges that this natural disappointment should not be allowed to lead us to excessive pessimism, for, apart from the silver agreement, sub-divisions of the Conference have done useful exploratory work, and laid down principles which can be followed in expert discussions. " Britons, in particular, must guard against, and combat, the notions that the experiences of June and July indicate the futility of all international conferences, or, still more dangerous, that the accumulating evidence of improvement in world trade removes the need for a co-operative tackling of our difficulties. As President Roosevelt rightly remarked, there is a need for each nation to set its house in order. But the world can never regain prosperity until international, as opposed to domestic, trade revives. And international trade cannot recover so long as problems such as indebtedness, tariffs, controls, and quotas, which can only be tackled co-operatively, are ignored." This is a plain statement of the facts, which cannot be too strongly, or too often, stressed.

It is, unfortunately, perfectly true that " the Conference provided plenty of targets for the cynics. The delay in its inception; its chequered opening deliberations; the emasculation of its agenda after three weeks of endeavours to find common ground; the academic flavour pertaining to its reports—these were easy game for those who scoff at all efforts to improve our economic position by international conferences." But we agree with the *Review* that what has been accomplished will provide a basis for a renewed Conference in the autumn—should the difficulties which stood in the way of the first one be by that time dispelled.

PERSONAL

Alderman R. KIRK, who for the past few years has been Chairman of the Rotherham Gas Committee, and is well known to many members of the Gas Industry, has accepted the invitation to become Mayor of Rotherham next year.

* * *

Mr. S. SOLOMON, who has been Works Manager of Messrs. Thos. Parsons & Sons, Ltd., Paint Manufacturers, Mitcham, for the last twenty years, has resigned his position and has been elected to the Board of Lansdown Varnish and Enamel Company, Ltd., Barnet. Mr. H. TALBOT, B.Sc., A.R.C.S., M.I.Chem.E., who has been closely identified with the work of the Chemical Engineering Group of the Society of Chemical Industry since its inauguration, and has served as Vice-President of the Society, was recently elected a Director, and appointed Secretary of the Company, which has just bought a factory at Barnet.

* * *

Mr. T. THORNTON, Engineer, Manager, and Secretary to the Rowley Regis and Blackheath Gas Company, has been placed on the Commission of the Peace for Staffordshire. He represented the Rowley Regis Ward on the Urban District Council for nine years prior to 1931, when he was defeated at the polls. For seven years he was Chairman of the Highways and General Purposes Committee. He has been Vice-Chairman of the Council, and is at present Vice-Chairman of the Rowley Regis Employment, Occupational, and Recreational Committee. He has for a number of years taken an active interest in the work of the Blackheath and Rowley Regis Hospital Committee.

* * *

At a Directors' meeting of the Whitwood Chemical Co., Ltd., held at Leeds on Aug. 17, the staff of the firm presented Dr. WALTER HARGREAVES, J.P., the Chairman of the Board, with a silver cigarette casket, to mark the fiftieth anniversary of the Company's inauguration. At the staff's request the presentation was made by Mr. Alexander Dempster, one of the original Directors of the Company.

OBITUARY

The death took place, on Aug. 12, at his residence, Bannerdown House, Batheaston, Bath, after a brief illness, of Mr. A. W. RANKEN, Senior Director of Messrs. Aldridge & Ranken, Ltd.

Correspondence

C. Taylor v. A. H. Barker.

SIR,—Our attention has been drawn to your recent reports of the above lawsuit, which you have published under the heading "'Rayrad' Heating Case."

May we point out that the action in question related to the "Gas-Rad" system of heating. The "Rayrad" system relates to the employment of our patent "Ideal Rayrad" (the word "Rayrad" is a registered trade mark), which is a type of panel radiator introduced by us in 1926, and since employed in many hot water and steam heating installations throughout the United Kingdom. Except in a few cases of gas-fired boilers, the ordinary type of coke, anthracite, or oil-fired boiler has been used, and in view of the many hundred "Rayrad" installations in existence, confusion must arise, by reason of your associating the "Ideal Rayrad" system with the "Gas-Rad" type, which was the subject of the recent action.

It is true, of course, that we have manufactured such "Gas-Rad" panels as have been used so far, but the two systems are obviously different, and we would ask you to clear the air by publishing this information.

Yours, &c.,
W. G. CASE,
Technical Manager.

National Radiator Company, Ltd.,
Great Marlborough Street,
London, W. 1,
Aug. 18, 1933.

THE NEWS OF THE WEEK

The Kinross Gas Company report a profit for the year of £1115. A dividend at the rate of 7½% less income-tax, was approved.

The Paisley Gas Committee has recommended that no action be taken regarding the proposed purchase of the Nitshill and Hurlet Gas Light Company.

Camborne Gas Company, meeting on Friday, Aug. 18, under the presidency of Mr. S. J. Ingram, Chairman and Managing Director, declared a dividend of 5%, less tax.

Gas Supplied to the Buckie Town Council by the Buckie Gas Light Company, which is under new ownership, has been reduced in price from 5s. 5d. to 4s. 2d. per 1000 c.ft.

Gas Prices in Huyton and Roby have been brought into line with those ruling in the Liverpool area. For gas supplied through ordinary meters, the price will be 7·4d. per therm, and for that supplied through prepayment meters 8·9d. per therm.

The Perth Town Council has resolved to make a reduction in the price of gas. It was stated that the Gas Department had earned a profit of £2741, which thus permitted of a reduction of 2d. per 1000 c.ft. The rate for the current year was fixed at 3s. 4d. per 1000 c.ft.

Australian Gas Institute.—We have received from the Institute a copy of the Transactions for 1932, which includes reports of the Sixth Annual Convention held in Sydney under the Presidency of Mr. S. J. Janes, and of the meetings of the Northern and Southern Sections.

A Price Reduction of ¼d. per therm has been decided upon by the Hebden Bridge and Mytholmroyd Gas Board.

Despite Electrical Competition, the Hadleigh Gas Consumers' Company, Ltd., have again secured the contract for lighting the street lamps in Hadleigh, Suffolk. Sixty-five lamps are to be lighted, and four of these will be all-night lamps. The contract is for a period of five years.

Price of Gas in Aberdeen.—The following scale of gas charges has been fixed by the Gas Committee of the Aberdeen Town Council: 2s. 3d. per 1000 c.ft. for the first 5000 c.ft. per quarter, and 1s. 9d. per 1000 c.ft. for the next 45,000 c.ft. Above this the price gradually falls to 1s. 4d. as the consumption rises.

A French Industrial Heating Congress is to be held in Paris from Oct. 9 to 15 next. Among the subjects to be discussed are the production and utilization of combustibles, the generation and use of steam, and the direct employment of combustibles in engines. Full particulars of the congress can be obtained from M. P. Coutouraud, 5, Rue Michel Ange, Paris XVI.

The Spanish Production of Crude Coal Tar declined from 44,600 tons in 1931 to 35,900 tons in 1932, the last-mentioned figure being made up of 16,000 tons of coke-oven tar and 19,900 tons of gas-works tar; and the 1932 total of 25,700 tons of coke-oven tar and 18,900 tons of gas-works tar. For 1931 the following materials were produced at gas-works and coke ovens: Benzole, 5399 tons; creosote oil, 2800 tons; pitch, 4895 tons; and naphthalene, 770 tons.

XUM

British Nitrate of Soda.—The price of this fertilizer, which has recently been quoted by Imperial Chemical Industries, Ltd., at £7 5s., is now announced as follows for delivery in the months stated: £7 8s. 6d., August/October; £7 11s., November; £7 13s. 6d., December; £7 16s., January; £7 18s. 6d., February/June. These prices are the same as those now ruling for the Chilean product.

Royal Sanitary Institute.—The Autumn Session of training courses for examinations for sanitary inspectors, smoke inspectors, Associateship (general hygiene and sanitation), and in sanitary science will commence on Monday, Sept. 18. Syllabuses of the lectures and of the examinations containing full particulars are obtainable from the Secretary of the Institute, 90, Buckingham Palace Road, London, S.W. 1.

Under the Board of Trade Regulation the Wallasey price is 7·66d. per therm, less discount, as against the Hoylake price of 10·32d. per therm. The Saughall Massie gas consumers are now, therefore, able to enjoy a reduction of no less than 1s. 1d. per 1000 c.ft. The service will also include the supply of new appliances and complete installations for the home, fixed free, on very easy terms of payment and no deposit.

Gas Progress in the Argentine.—The report of the Province of Buenos Aires Gas Company, Ltd., and the Primitiva Gas Company of Buenos Aires, Ltd., for the past year shows that the sales of gas during the twelve months amounted to 2,102,888,000 c.ft. as compared with only 2,053,143,000 c.ft. in 1931—an increase of 45,745,000 c.ft., or about 2·42%, the latter figure contrasting with an increase of 9·02% between 1931 and 1930.

Increasing Gas Production in Switzerland.—According to a report just issued by the Association of Swiss Gas and Water Engineers, the output of gas from the various works in Switzerland showed a further increase during the first half of the current year, the production having reached a total of roundly 4,394,850,000 c.ft., as contrasted with only 4,327,780,000 c.ft. in the corresponding half of 1932—an increase of 67,070,000 c.ft., or just over 1½%.

A Net Trading Loss of £16 7s. 5d. was sustained after providing a sum of £71 3s. for depreciation, on the year's working of the Keady, Co. Armagh, Gas Undertaking. The total deficit was £83 0s. 9d. The Council Chairman (Mr. James Arthurs) said that according to this there was no improvement over last year, and it would be better to refer the report to a committee of the whole Council. It was a most serious matter for the ratepayers. Mr. Ewart suggested closing the gas-works altogether, and the report was referred to a Committee of the Council.

B.I.F. Publicity.—The Department of Overseas Trade announce that they have re-appointed Dorland Advertising, Ltd., as their advertising agents for next year's British Industries Fair which opens in London and Birmingham on Feb. 19, 1934. The agents for the separate advertising of the Birmingham section will be, as for the last Fair, Amalgamated Publicity Services, Ltd., London. Mr. Sydney Walton will again direct the news service of both the London and Birmingham sections of the Fair, and the news for these sections will be handled by Mr. Robert Williamson from 10, Adam Street, Adelphi, W.C. 2.

Gas "Going Stronger than Ever."

Interesting details of the South Molton, North Devon, Municipal Gas Undertaking were given recently when Mr. H. E. Bryne, a Ministry of Health Inspector, held a local Inquiry respecting the South Molton Town Council's application for sanction to borrow £6300 for the extension of their works and plant.

The Town Clerk informed the Inspector that the money was required for the erection of a new gasholder of 100,000 c.ft. capacity, purifiers, and other equipment. A new gasholder was absolutely necessary as the existing one, erected in 1853, was in a bad condition.

He added that the Undertaking was purchased by the Corporation in 1896, and some of the plant was now out of date. On the average figures of the Undertaking for the last five years a balance of only £41 16s. 9d. of the loan would have to be met by the rates.

The Engineer and Manager (Mr. T. M. Macdougall) said that the present storage capacity was only 26,000 c.ft. The pressure was insufficient, and in his view the proposed improvements were absolutely necessary. Under the existing conditions the supply could not be improved, and there were people in the distrct who had been wanting gas for years but could not be supplied. The Undertaking nad never been a charge on the rates, and in his view would continue to be self-supporting.

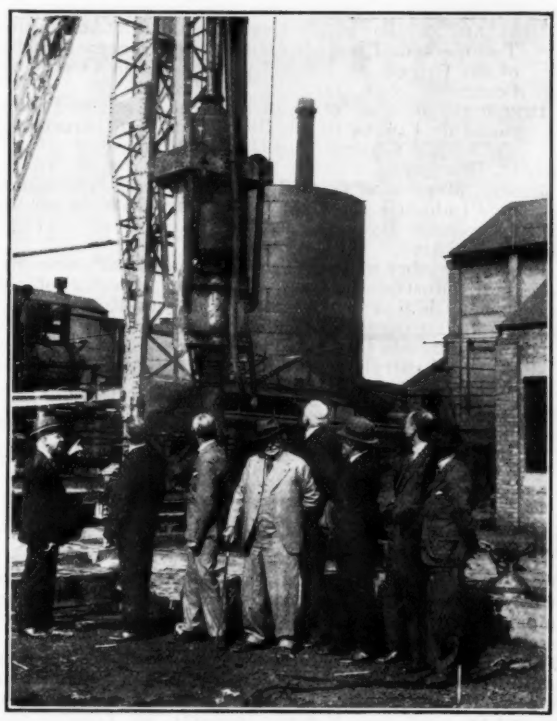
It was suggested by opposition at the Inquiry that the expense was not justified, as the Undertaking had a formidable rival in the local Electricity Company, but alluding to this the Inspector observed he did not think they could set off one against the other.

In most places actually gas was going stronger than ever. The Inspector added he thought the price of gas at South Molton, 5s. per 1000 c.ft., rather high.

After visiting the works the Inspector concluded his Inquiry.

New Retort Installation at East Hull.

The accompanying photograph is of the pile driving plant driving the first pile in connection with the new Glover-West retort installation at the works of the East Hull Gas Company.



From left to right: Messrs. R Nelson, Engineer and General Manager; George M. B. Jalland, Director; C. N. Jackson, Deputy-Chairman: Boswell G. Jalland, Chairman; F. J. Gardam, Director; McLennan (West's Gas Improvement Company, Ltd); T. W. T. Hammerton, Secretary; and B. Stonham, Assistant Engineer.

The installation will consist of 18 Glover-West vertical retorts of the 50-in. New Model, arranged in nine distinct and separate units, each containing two retorts, and complete with three producer gas generators, retort house building, coal handling plant—including coal store, coke storage hoppers, and coke grader—waste-heat recovery plant, and stokers' rest room, all to be completed within ten months from Aug. 10. The Contractors for the complete plant are Messrs. West's Gas Improvement Company, Ltd., and the piling is being carried out by West's Rotinoff Piling and Construction Company, Ltd.

Wakefield Company's Cricket Success.

A Fine Sports Ground.

The Cricket Team of the Wakefield Gaslight Company's Sports Club has been successful in winning the "Montagu Burton" Cup which is open for competition to all workshop clubs in the Wakefield district.

The result is very gratifying, as the Sports Club, which is run on co-partnership lines, has only been in existence for four years. The sports ground which is situated at the works was unfortunately not large enough to allow the cricket members to enjoy their pastime there, but there are two tennis courts and a bowling green which are in

THE NEWS—continued.

constant use throughout the summer, as 95% of the staff and employees are members of the Club.

A feature of the layout is the very fine gardens, which have been almost entirely stocked by the members. There are shubberies, herbaceous borders, and ornamental beds, which have been much admired by visiting clubs, the members of which expressed great surprise at the healthy appearance of the gardens in spite of their proximity to the gas-works.

French Delegation to Canada and U.S.A.

The following members of the French Gas Industry, under the leadership of M. A. Baril, will attend the 26th Canadian Gas Convention and the 15th American Gas Convention:

A. Baril, Vice-President of the Union Internationale de l'Industrie du Gaz; Past-President of the Association Technique de l'Industrie du Gaz en France; Assistant General Manager of the Société d'Eclairage, Chauffage et Force Motrice.

Mme. A. Baril.

M. Bernard, Member of the Committee of the Association Technique de l'Industrie du Gaz en France; Director of the Groupe du Nord des Usines de la Compagnie Continentale du Gaz.

G. Descours, Member of Council of the Syndicat Professionel de l'Industrie du Gaz; Managing Director of the Société Générale des Gaz du Midi.

Mme. G. Descours.

G. Monod, Member of Council of the Syndicat Professionel de l'Industrie du Gaz; Managing Director of the Compagnie Hydro-Electrique d'Auvergne.

Mme. G. Monod.

R. Piaton, Member of Council of the Syndicat Professionel de l'Industrie du Gaz; Managing Director of the Société de Gaz et d'Electricité du Sud-Est.

G. Reclus, Treasurer of the Association Technique de l'Industrie du Gaz en France; Chief Engineer of the Service Central des Abonnés de la Société du Gaz de Paris.

Mme. G. Reclus.

R. Seurot, Chief Engineer and Director of the Services Techniques de la Société du Gaz de Paris.

Mme. R. Seurot.

Largest Blast Furnace Gas Cleaning Plant.

Messrs. Lodge-Cottrell, Ltd., advise us that they have recently received the order from the Tata Iron and Steel Company, Ltd., for what will be the largest blast furnace gas cleaning plant of any kind in the world.

This will be an electrostatic plant of the two-stage fine cleaning type, such as is now being installed by the same Company for the South African Iron and Steel Industrial Corporation, and also Messrs. Stewarts & Lloyds' new plant at Corby.

The gas volume is 14 million c.ft. per hour measured at N.T.P., and the guaranteed performance is that the dust content shall not exceed 0·0088 grain per c.ft. (= 0·020 gramme per cub.m.). The average dust content in the crude gas reaches the very high figure of 16 grains per c.ft. (= 37 grammes per cub.m.), so that an exceedingly high performance is called for. The gas will be cooled to a temperature between 104° F. and 122° F., the relatively high temperature being due to the fact that the cooling water available will range between 80° and 100° F. The cooling water will be re-circulated, in view of the need for economy, and the make-up water is only to be 5000 gallons per hour.

Normally the plant will take gas from the three large blast furnaces, but it will be centralized and will consist of four pre-coolers, eight first-stage electro-filters, bringing the dust down dry, eight final coolers, and eight second-stage electro-filters, to extract the residual dust and all moisture in suspension. A very complete range of instruments, for indicating and recording temperature pressure, gas volume, and the dust content of the cleaned gas, is included. A large degree of automatic control is being installed, in order to reduce the cost of attendance.

The gas will be used first to supply the stoves and boilers, a new power station being planned. Later on the clean gas will also be used for firing coke ovens, and also in the steel-works, where it will be mixed with coke oven gas for any special high-temperature work. The installation of proper gas cleaning was decided upon as the first step in their fuel economy campaign, and the Tata engineers not only visited a large number of countries to see the various types of gas cleaning plant available, but also consulted the leading experts in America and Germany, as well as in this country before coming to their decision. The award of the order is therefore a considerable triumph for British engineering.

Success of Sliding Scale at Greenock.

Gas Charges Further Reduced.

The Greenock Corporation Gas Department closed the financial year at May 15, 1933, with a gross profit of £23,611. After repaying instalments on loans amounting to £11,255, interest on loans £4942, property and income-tax payments £2417, and placing £1500 in reserve, there remained a net profit of £3497 on the year's working. A contribution of £2000 has been voted to the Burgh General Department out of this surplus.

The Engineer's recommendation that the price of gas to prepayment consumers be reduced from 2s. 7·775d. to 2s. 6d. per 1000 c.ft., and that the sliding scale of charges for gas consumed through ordinary meters be revised, was duly approved.

The sales of gas increased by 17,685,000 c.ft., or 2·8%, during the year, in spite of continued trade depression.

There is no doubt that the popularity of the sliding-scale method of charging for gas has largely helped to make possible the increase of 23% in gas sales experienced in the 14 years' period that this system of charging has operated in Greenock. As will be seen from the recently revised scale of charges for gas set out below, a price in the region of 6d. per therm is now well within the reach of householders who take full advantage of their gas service, while at the same time very competitive rates are made available for industrial consumers.

Revised Scale of Charges.

Prepayment consumers—7·317d. per therm (2s. 6d. per 1000 c.ft.).

Sliding Scale of Charges for Domestic and Industrial Purposes.

The rates charged for domestic and industrial purposes are according to consumption per quarter, and are as under:

Scale.		Therms.			Price per Therm.
					d.
A 1			Up to	20·5	7·25
2	Over	20·5	and ,,	41·0	6·75
3	,,	41·0	,, ,,	102·5	6·25
4	,,	102·5	,, ,,	307·5	6·00
5	,,	307·5	,, ,,	1,025·0	5·50
6	,,	1,025·0	,, ,,	2,050·0	5·25
7	,,	2,050·0	,, ,,	4,100·0	5·00
8	,,	4,100·0	,, ,,	8 200·0	4·75
9	,,	8,200·0	,, ,,	12 300·0	4·25
10	,,	12.300·0			4·00

Scale.		C.Ft.			Equivalent per 1000 C.Ft.
					s. d.
A 1			Up to	5,000	2 5·725
2	Over	5,000	and ,,	10,000	2 3·675
3	,,	10,000	,, ,,	25,000	2 1·625
4	,,	25,000	,, ,,	75,000	2 0·600
5	,,	75,000	,, ,,	250,000	1 10·55
6	,,	250,000	,, ,,	500,000	1 9·525
7	,,	500,000	,, ,,	1,000,000	1 8·500
8	,,	1,000,000	,, ,,	2,000,000	1 7·475
9	,,	2,000,000	,, ,,	3,000,000	1 5·425
10	,,	3,000,000			1 4·400

Latest Benzole Tanker.

The *M.V. Ben Henshaw*, the latest addition to the National Benzole Company's fleet, is being launched at the yard of the Rowhedge Ironworks Company, near Colchester, to-morrow.

An increasing demand for spirit produced from British coal is stated to be the reason for the building of this new vessel, which will carry more cargo and be faster than its predecessors. It is of 350 tons, and is fitted with two Diesel electric engines capable of propelling the vessel at a speed of over 9 knots.

The whole of the electrical equipment of the vessel will be carried out in flame and explosion proof machinery and fittings.

Forward of the engine room will be arranged the bunkers for the fuel oil for the Diesel engines, and these

will carry 38 tons, which will be sufficient for propelling this vessel nearly 5000 miles.

The cargo tanks, of which there will be eight, will be capable of carrying 300 tons of petrol and will be so arranged as regards size as to allow 300 tons of benzole, which is of heavier gravity than petrol, to be carried in six tanks.

The pipelines in the cargo tanks and pump room will be so fitted that two grades of spirit can be loaded or discharged from the vessel simultaneously without fear of contamination.

The pump room will be positioned between the fuel bunkers and the cargo tanks and will be fitted with two cargo pumps each capable of pumping 30,000 gallons of motor spirit per hour.

The hull of the vessel, machinery, and equipment are of British materials throughout, and are built especially strong to stand the strains to which they will be subjected when lying aground at certain berths.

Meter Testing in Glasgow.

In his report on the work of the Glasgow Gas Meter Testing Department for the year ended May 31, 1933, Mr. S. B. Langlands, the Inspector, states that the total number of meters tested was 33,343, and the amount of fees collected £2031. These figures are a decrease on those of 1932. Of the total number of meters tested, 8644 were new meters, 24,287 were repaired meters, and 412 were sent in by gas consumers for certification as to correctness.

The following is a summary of the results of testing:

New Meters.		Repaired Meters.		Meters sent by Consumers for Certification.	
Correct and Stamped.	Rejected.	Correct and Stamped.	Rejected.	Correct and Stamped.	Rejected.
8540 98·8%	104 1·2%	23,841 98·2%	446 1·8%	126 30·6%	286 69·4%

ANALYSIS OF FAULTS AND ERRORS.

Nature of Fault.	New Meters.	Repaired Meters.	Meters sent by Consumers for Certification.
Fast in registration	75	187	161
Slow in registration	13	153	44
Passing gas but not registering	..	13	1
Ceased to register (bound)	3	9	..
Leakage	4	9	5
Passing unregistered gas	..	4	4
Drawing lights (oscillation)	4	32	62
Excessive absorption of pressure	1	26	..
Other faults	4	13	9
	104	446	286

Proposed Supply of Coke Oven Gas for Glasgow.

One of the items up for consideration at the meeting of the Works and Distribution Sub-Committee of the Corporation Gas Department held in Glasgow on Aug. 14 was the proposal to supply coke oven gas made recently by Messrs. Wm. Baird & Co., coal and iron masters, Gartsherrie, Lanarkshire. Owing, however, to the importance of this offer no decision was reached, and it was decided to refer it to the parent Committee.

The offer, which has already been commented on in these columns, arises out of the decision of Messrs. Baird to erect new furnaces and ovens at Gartsherrie in an endeavour to revive the production of pig iron in Scotland. The proposal, as it stands at the moment, is that the Gartsherrie Iron Works be taken over by a limited liability company with a capital held by Messrs. Baird. This Company will have control of the iron works and a number of collieries in Lanarkshire, Stirlingshire, and Dumbartonshire, and will thus be assured of a supply of good coking coal. The new ovens which will be erected at Gartsherrie will be fired with blast furnace gas, and there will be thus available a large excess of good quality coke oven gas suitable for domestic and industrial use.

The success of the scheme depends, to a large extent, on obtaining a suitable outlet for this gas; and it is with this point in view that the Corporation of Glasgow has been approached. The exact quantity of gas to be supplied could not be agreed upon until the Company had had six months' experience of running the plant, but it is suggested that it would be about 6,250,000 c.ft. per day of a quality of approximately 480 B.Th.U. This gas, it is hoped, would be supplied at a cost of 8·4d. per 1000 c.ft. As security the Company propose to lodge with the Corporation a sum of £5000, bearing interest at 3½% per annum, and guarantee to keep a sufficiency of coal in reserve to meet Corporation requirements in event of accidents and strikes.

Carnival Display at Canterbury.

Our photograph shows one of the cars entered by the Canterbury Gas and Water Company in the parade in connection with the recent carnival in aid of the Kent and Canterbury Hospital. The display was part of the Company's publicity scheme as an aid to gas sales, and aroused considerable interest.

Petrol by Hydrogenation.

Writing in *The Times* of Aug. 15, Mr. L. H. Sensicle, F.I.C., of Messrs. Gas Chambers and Coke Ovens, Ltd., of Artillery House, Westminster, S.W. 1, said:

May I suggest that a point worthy of mention in your columns is the suitability of bye-product coking installations, and even gas-works, as locations for the establishment of relatively small hydrogenation plants? Coke oven gas, which is often a surplus product with no ready outlet, is a known source of cheap hydrogen which might be applied to the hydrogenation of coal or tar, while the surplus energy commonly available from such sources as coke cooling, and the combustion of washery and de-dusting plant products, would find an outlet in supplying the heat and power also needed for the process.

As an example, a coke oven plant within a group of collieries carbonizing, say, 1200 tons of coal a day and furnished with a hydrogenation plant capable of treating 200 tons a day, could produce over 10 million gallons of petrol per annum, while the rich hydrocarbon gases also yielded would be equivalent to a further 3 million or 4 million gallons if supplied compressed for motor transport. These products would be additional to the usual coke, tar, sulphate of ammonia, and benzole from the ovens, while in the course of separating hydrogen from the oven gases ethylene could be worked up into a quantity of alcohol equal to the make of benzole. The ovens would be heated by the residue of the coke oven gas after hydrogen preparation. Development on these lines at a number of centres would stimulate expansion of the carbonizing industry, materially increase coal output, and assist smoke abatement.

CARBURETTED-WATER-GAS AS A COAL-GAS AUXILIARY - -

By
Humphreys & Glasgow, Limited.

AN APPRAISAL OF FINANCIAL BENEFITS OF CARBURETTED-WATER-GAS IN GREAT BRITAIN, WHICH ARE NOT DISCLOSED IN USUAL SYSTEMS OF ACCOUNTING.

FORE-WORD:

In view of the new British Customs Duty of one penny per gallon on heavy oil (including gas-oil), which at first sight might appear to compromise the unique functions of "Carburetted-Water-Gas as a Coal-Gas Auxiliary," it seems opportune to review this Co-partnership of Carburetted-Water-Gas and Coal-Gas, in the light of present facts.

Although it is a moot question between the two fiscal schools (Free Trade *v.* Customs) whether the domestic consumer or the foreign producer pays the duty, in this treatise the whole Duty is added to the domestic price, regardless of any share ultimately borne by the producer, or of any present or future domestic sources of supply.

It should be remembered, however, that this Duty on gas-oil is not an ordinary item of expense in the cost of gas, but is a contribution in relief of general taxation; therefore, when spread over the many millions of direct and indirect users of gas, its payment is much like changing money from one pocket to the other.

As this new Duty is chiefly to protect domestic coal from the present competition of foreign oil, the effort will be practically futile unless it increases the price of coal—and consequently of Coal-Gas. Nevertheless, in all following comparisons, the previous cost of Coal-Gas is unchanged, while 1d. per gallon is added to the liberal average of 3d. taken for the pre-duty price of gas-oil.

With gas-oil taken at 4d. per gallon throughout this Treatise, the analyses reveal the following overwhelming case for "Carburetted-Water-Gas as a Coal-Gas Auxiliary."

FORE-CAST OF THE CASE:

Part I. will show that Peak-Load Carburetted-Water-Gas is cheaper to manufacture than Coal-Gas *per se;* that, including works Capital Charges, Peak-Load Carburetted-Water-Gas costs only three-fifths of the cost of Peak-Load Coal-Gas for the same service!

Part II. will show that the whole new Duty of one penny per gallon on all gas-oil used in Great Britain is but a small fraction of the REFLEX BENEFITS of Carburetted-Water-Gas in the gas-coal and residual markets!

Part III. will show the PERMANENCE of the Advantages of "Carburetted-Water-Gas as a Coal-Gas Auxiliary" in the United Kingdom, from its first introduction in 1891 to the present time!

It should be noted particularly that neither the Direct Savings nor Reflex Benefits in Coal-Gas production, caused by the use of Carburetted-Water-Gas, are ever credited to Carburetted-Water-Gas in the accounts or in usual comparisons with Coal-Gas.

On the contrary, the usual systems of gas-works accounting give to *Coal-Gas* the whole of these savings and benefits due to Carburetted-Water-Gas—even to the extent of charging the Carburetted-Water-Gas with its coke at the higher price which its use creates!

INTRODUCTION.

Although it is generally agreed that the joint manufacture of Carburetted-Water-Gas and Coal-Gas has many advantages over the production of Coal-Gas alone, the enormous financial value of these advantages is seldom appreciated.

Even in determining the character of new plant, these "joint" advantages are too often regarded merely as desirable conveniences, rather than as large definite savings to be ascertained and weighed in any decisive comparison of ultimate costs.

Such views may be grossly misleading, for it will be shown herein that, even if the manufacturing cost of the Carburetted-Water-Gas were higher—unprecedentedly higher—than that of the Coal-Gas, a mixture of the two in suitable proportions would be cheaper, and far cheaper, than the Coal-Gas alone.

This present Discussion divides itself into Three Parts:

Part I. deals with Direct Savings realized by the use of Carburetted-Water-Gas instead of Coal-Gas for "peak-load" service.

Part II. indicates "Reflex" Benefits, in the purchase of gas-coals and in the sale of residuals, due to the use of Carburetted-Water-Gas.

Part III. illustrates the PERMANENCE of the Auxiliary Advantages of Carburetted-Water-Gas from its first introduction in the United Kingdom to the present time.

No attempt is made to value the other Collateral Advantages of Carburetted-Water-Gas.

For the benefit of non-technical readers it may be well to explain that this Treatise deals with Operating Strategy rather than with engineering technics; because Carburetted-Water-Gas Processes are now technically so perfect that by far the greatest future savings will be found in perfecting *strategically* the Co-partnership between Carburetted-Water-Gas and Coal-Gas.

No one should accept these conclusions as necessarily applicable to his own case. Each case must, of course, be determined by local costs; but normal variations in costs will not greatly change the broad conclusions reached herein, if the relative capacities and outputs of Coal-Gas and Carburetted-Water-Gas are as described.

PART I.

Appraisal of the Direct Financial Benefits of Carburetted-Water-Gas for Peak-Load Service.

NOTE.—Those who have not time for the intervening Argument will find the conclusions to Part I. summarized later.

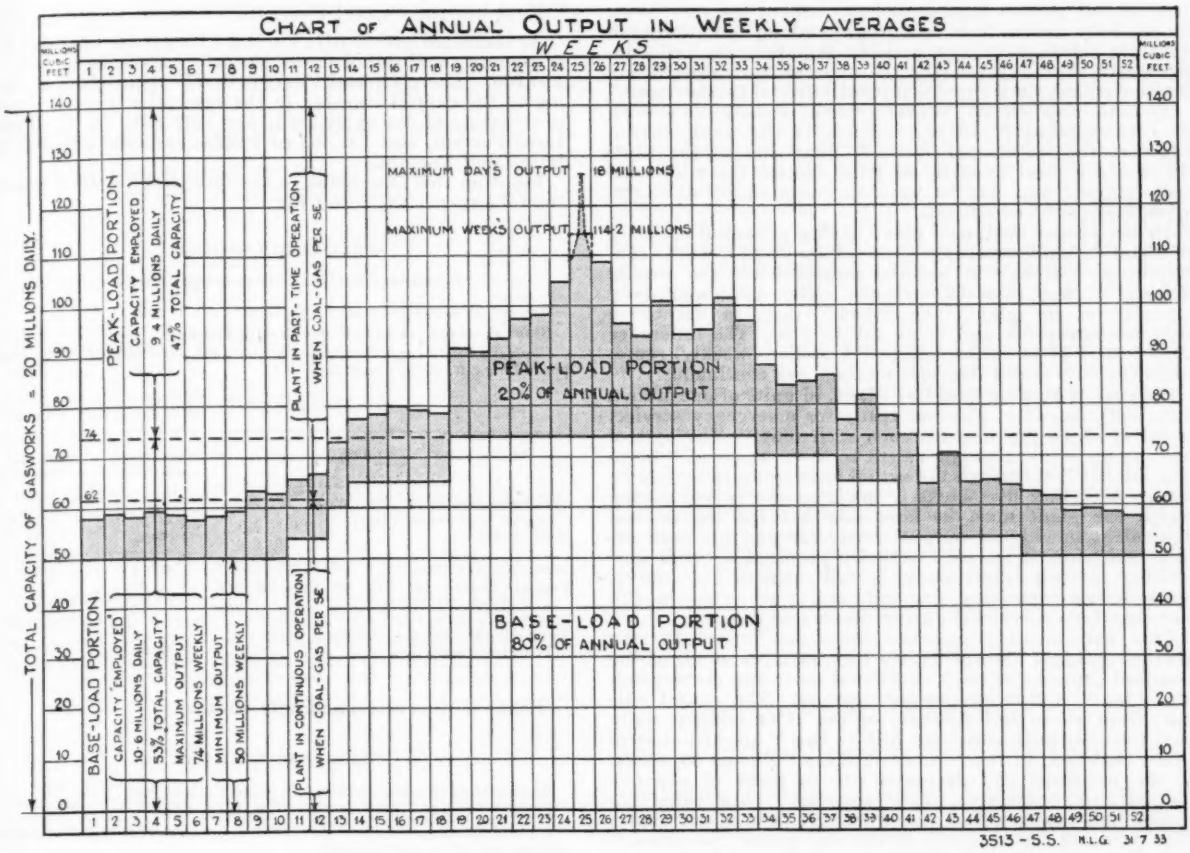
The CHART accompanying this Treatise shows the output each week in the year of an English Gas-works of the following size:

	C.Ft. Millions.
Total Annual Output (500 B.Th.U. gas)	4000
Maximum Week's Output	114
Maximum Day's Output	18
Total Daily Capacity ; all in use or in suspense ready for emergencies during period of possible maximum output	20

This Gas-works is of large capacity, but the Argument is applicable to all Gas-works large enough for dual sytems of production. In works too small for automatic clinkering, manually clinkered plant will effect corresponding savings.

For convenient comparison and conversion (at 5 therms per 1000 c.ft.), and to cover severe "stripping" of benzole and steaming of retorts, the Coal-Gas, the Carburetted-Water-Gas, and the Town-Gas are all three taken in Part I. at the same quality of 500 B.Th.U.

For the purposes of this Part I., the annual production of gas is divided into Two Portions: The first, representing conditions favourable to high Coal-Gas economy, is called the "Base-Load" Portion, and is allotted exclusively to



Coal-Gas; while the other, or "Peak-Load" Portion, embracing all especially adverse Coal-Gas conditions, is utilized to compare Coal-Gas with Carburetted-Water-Gas for "peak-load" service.

This Peak-Load Portion, therefore, includes the extra fuel, labour, wear and tear, &c., required to keep ready for prompt gas-making as much plant as may possibly be needed, not only for normal variations in demand, but for emergency service. It further involves greatly increased capital charges per unit of output.

The most profitable ratio between the Coal-Gas Base-Load Portion and the Peak-Load Portion, if Carburetted-Water-Gas, varies with the relative costs of Coal-Gas and Carburetted-Water-Gas. In the present example, 20% only of the total annual output is allotted to the Peak-Load Portion, as being the minimum which develops the Auxiliary Advantages of Carburetted-Water-Gas.

Of the *total annual output* of 4000 million c.ft., 3200 millions are in the Base-Load Portion, and 800 millions are in the Peak-Load Portion (shaded on the Chart). This Peak-Load Portion includes the entire output above the 74-million weekly line and all indicated by the shading below this line.

Of the *total daily manufacturing capacity* of 20 million c.ft., the Base-Load Portion requires 10·57 millions daily or 52·85%; the remaining 9·43 millions daily or 47·15% are for the Peak-Load Portion.

Capital Investment is included herein up to the outlet of station meter—excluding holders; and is taken at £45,000 for Coal-Gas and £20,000 for *Auxiliary* Carburetted-Water-Gas, per million c.ft. of daily capacity. The new Coal-Gas Works at Oxford, described as "cheap" and "at very low cost" in the discussion of Mr. Caton's comprehensive paper ("GAS JOURNAL," June 12, 1929, pp. 737-38), cost complete to outlet of Station Meter £50,970 per million daily.

The present problem compares the Capital Cost of Coal-Gas Works (or of Extensions bearing their proportion of such cost) with the cost of Auxiliary Carburetted-Water-Gas Works dovetailed efficiently into such Coal-Gas Works; but the conservative "complete" figure of £45,000 per million daily capacity is taken for the Coal-Gas, instead of the Oxford cost of £50,970.

The large ground space and developments needed for Coal-Gas Works, and the extensive mechanical facilities required to deal with coals and residuals in Coal-Gas manufacture, are not needed for Auxiliary Carburetted-Water-Gas Works—which usually occupy only space thus saved. The fact that the relief holder for Carburetted-Water-Gas (generally a small obsolete Coal-Gas holder) stores only crude gas is more than offset by the smaller storage capacity required with Carburetted-Water-Gas Plant.

Capital Charges for Interest, Amortization, and Insurance are taken at the even inclusive figure of 10% on investment.

The Cost of the Peak-Load Portion must now be determined for both Coal-Gas and Carburetted-Water-Gas, and the benefits of Carburetted-Water-Gas rest upon this comparison, supplemented by the local importance of its "Reflex" and Collateral Advantages.

To this end, the first step is to establish the representative cost of Coal-Gas *per se* of 500 B.Th.U. in a modern Gas-works of this size; this is taken as follows:

COAL-GAS *Per Se.*

Annual Output.—4000 million c.ft. of 500 B.Th.U. gas.
Plant Provided.—20 million c.ft. daily capacity.
Capital Investment to Outlet of Meter.—£900,000—Estimated at £45,000 per million c.ft. of daily capacity.

Cost of Coal Gas per se.

—	Pence per 1000 C.Ft.	Pence per Therm.
Manufacturing Cost *less* Wear & Tear	10·60	2·12
Wear & Tear	4·00	0·80
Manufacturing Cost	14·60	2·92
Capital Charges at 10% on £900,000 = £90,000 or	5·40	1·08
Total Works Cost (to Outlet of Meter) of Coal-Gas *per se*	20·00	4·00

The above Cost of Coal-Gas *per se* must next be divided between the Peak-Load Portion, and the Base-Load Portion.

In this division, Peak-Load Coal-Gas is sur-charged with meeting demands only so far as *quantity* is concerned; on the other hand, Peak-Load Carburetted-Water-Gas equalizes supply and demand for both quantity *and quality*, thus enabling Base-Load Coal-Gas Plant to work at its highest thermal efficiency, without regard to quality. In the following comparisons of costs, no credit is given Peak-Load Carburetted-Water-Gas for this additional "peak-load" service.

PEAK-LOAD COAL-GAS.

Additional Fuel, Labour, Operating Supplies, &c.:

Surplus Plant to meet all possible demands must be ready for prompt gas-making whenever required. Such Plant

(except any portion kept heated throughout the year) must be carefully heated from cold to gas-making condition each year, in advance of any possible requirement, and subsequently kept idly hot (or the general equivalent at reduced output), until there is no possibility of further need.

To determine whether shutting down, or continuous work at correspondingly reduced output, is the more advantageous, the additional Wear & Tear due to the shutdown and re-heat must be weighed against the additional fuel, labour, &c., due to working continuously at correspondingly reduced output.

In the present instance, plant having a normal capacity of about 62 millions weekly (8·86 millions daily) works continuously, although at reduced output while the weekly demand is less than 62 millions. The maximum daily capacity of the plant "employed" (*i.e.*, in use or in suspense ready for use) is 20 million c.ft. The difference 20 − 8·86 = 11·14 millions daily (78 millions weekly) represents capacity which does not produce gas continuously.

The cost of keeping Coal-Gas Plant, in units of one million c.ft. daily capacity, idly hot ready for emergency service, is taken at £6 per day for each such unit.* The cost of heating-up is taken as equivalent to three weeks of "keeping idly hot" (although the actual heating-up time may be less). A further five weeks is taken as the period during which the plant must be kept idly hot (or the general equivalent in reduced output) ready for possible need before and after it may be actually required for full gas-making—namely, three weeks in full suspense (or equivalent) during increasing demand, and two weeks in full suspense (or equivalent) during decreasing demand.

This five weeks "suspense equivalent" includes the average gradual absorption, by increasing demand, of the required capacity of each additional unit; and corresponding "lag" during decreasing demand. The actual output, from *nil* to full demand, of the 11·14 millions daily part-time capacity is subject first to this "upward absorption" and then to this "downward lag" during 39 weeks. If the increases and decreases are in units of say one million daily capacity, this "suspense" will equal 3·5 weeks half-capacity for the whole 11·14 millions daily. This accounts for 1¾ weeks of the five weeks "suspense" period.

The three weeks equivalent for heating-up increases this five weeks "suspense" to eight weeks; hence the total cost for the whole 11·14 millions daily part-time capacity amounts to (11·14 × 7 days × 8 weeks × £6 =) £3743 for the year, or 0·225d. per 1000 c.ft. of total gas production. Of this total sum, (24 × 3 weeks × £6 =) £432 is chargeable to heating-up the (74 − 50 =) 24 millions weekly of part-time capacity in the Base-Load Portion; the difference of £3311 is chargeable to Peak-Load Production.

These sums respectively represent 0·032d. per 1000 c.ft. of Base-Load Production, and 0·993d. per 1000 c.ft. of Peak-Load Production.

Thus (apart from Wear & Tear) "peak-load" service increases the operating costs of Coal-Gas for the Peak-Load Portion to (10·6d. − 0·225 + 0·993 =) 11·368d. per 1000 c.ft.; with a corresponding reduction to (10·6d. − 0·225 + 0·032 =) 10·407d. per 1000 c.ft. for the Base-Load Portion.

Now regarding *Wear & Tear*:

The average Wear & Tear of 4d. per 1000 c.ft., in the cost of Coal-Gas *per se*, given previously, must be divided between the Peak-Load and the Base-Load Portions.

For the most part, Plant of this description deteriorates about as rapidly when working at reduced output or intermittently as when working at proper capacity; in fact, the maintenance of some of such plant is necessarily included in its normal operation, whereas it requires special care and attention when idle. With certain apparatus, however, the Wear & Tear is more affected by, though by no means proportional to, the output.

If Wear & Tear on the Plant employed for the Peak-Load and the Base-Load Portions respectively were wholly proportional to the proper capacity of the Plant, the Wear & Tear for the Peak-Load Portion would be 9·43d. per 1000 c.ft. of Peak-Load Gas, and for the Base-Load Portion 2·64d. per 1000 c.ft. of Base-Load Gas. This ratio of Peak-Load Wear & Tear to Base-Load Wear & Tear is 3·57 to 1.

As a safer average, however, this ratio will be reduced to 3 to 1 in all succeeding comparisons. This makes the Wear & Tear for Peak-Load Coal-Gas 8·571d. per 1000 c.ft , or 1·714d. per therm, and for the Base-Load Portion 2·857d. per 1000 c.ft., or 0·571d. per therm.

* The Chief Engineer of the Gas Light and Coke Company, in evidence before a Government Committee ("Gas Journal," Dec. 11, 1929, p. 725), gave the cost of maintaining *five* million c.ft. of Coal-Gas Plant available for emergency as from £26 to £27 per day.

Next are the *Capital Charges*:

As indicated previously, Capital Charges for coal gas *per se* amount to a total of (20 × £45,000 = £900,000 @ 10% =) £90,000. These Capital Charges divide themselves according to the capital invested in the respective Portions: that is to say, £42,435 or 12·730d. per 1000 c.ft. for the Peak-Load Portion, and £47,565 or 3·567d. per 1000 c.ft. for the Base-Load Portion.

Limiting this Discussion to the foregoing cardinal points, the following is the result for

PEAK-LOAD COAL-GAS

Equalizing Supply and Demand in *Volume* only.

Annual Output.—800 million c.ft. of 500 B.Th.U. gas.

Plant Provided.—9·43 million c.ft. daily capacity.

Capital Investment to Outlet of Meter.—£424,350—Estimated at £45,000 per million c.ft. of daily capacity.

Cost of Peak-Load Coal-Gas

—	Pence per 1000 C.Ft.	Pence per Therm.
Manufacturing Cost *less* Wear & Tear (10·6d. − 0·225 + 0·993)	11·37	2·27 +
Wear & Tear	8·57	1·71 +
Manufacturing Cost	19·94	3·99
Capital Charges at 10% on £424,350 = £42,435 or	12·73	2·55
Total Works-Cost (to Outlet of Meter) of Peak-Load Coal-Gas	32·67	6·53

Below is the correspondingly cheaper

BASE-LOAD COAL-GAS.

Annual Output.—3200 million c.ft. of 500 B.Th.U. gas.

Plant Provided.—10·57 million c.ft. daily capacity.

Capital Investment to Outlet of Meter.—£475,650—Estimated at £45,000 per million c.ft. of daily capacity.

Cost of Base-Load Coal-Gas.

—	Pence per 1000 C.Ft.	Pence per Therm.
Manufacturing Cost *less* Wear & Tear (10·6d. − 0·225 + 0·032)	10·41	2·08
Wear & Tear	2·86	0·57
Manufacturing Cost	13·27	2·65
Capital Charges at 10% on £475,650 = £47,565 or	3·57	0·71
Total Works-Cost (to Outlet of Meter) of Base-Load Coal-Gas	16·84	3·37

Having now resolved the Coal-Gas *per se* into its Base-Load and Peak-Load Portions, the next step is to establish the Corresponding Representative Cost of Peak-Load Carburetted-Water-Gas, with modern Automatic Plant; this is taken as follows:

PEAK-LOAD CARBURETTED-WATER-GAS

Equalizing Supply and Demand in Volume and *Quality*.

Annual Output.—800 million c.ft. of 500 B.Th.U. gas.

Plant Provided.—9·43 million c.ft. daily capacity.

Capital Investment to Outlet of Meter.—£188,600—Estimated at £20,000 per million c.ft. of daily capacity.

Cost of Carburetted-Water-Gas for Peak-Load Service.

(Coke at 20s per ton; Oil at 4d. per gallon)

—	Pence per 1000 C.Ft.	Pence per Therm.
Manufacturing Cost *less* Wear & Tear	12·80	2·56
Wear & Tear	1·50	0·30
Manufacturing Cost of Peak-Load Carburetted-Water-Gas	14·30	2·86
Capital Charges at 10%* on £188,600 = £18,860 or	5·66	1·13
Total Works-Cost (to Outlet of Meter) of Peak-Load Carburetted-Water-Gas	19·96	3·99

* The same rate of 10% is taken for both Coal-Gas and Carburetted-Water-Gas, although the period of amortization is longer for Carburetted-Water-Gas than for Coal-Gas.

It may be interesting to compare the cost of Carburetted-

Water-Gas *per se* with the similar cost of the Coal-Gas *per se*.

CARBURETTED-WATER GAS *Per Se*.

Annual Output.—4000 million c ft. of 500 B.Th.U. gas.

Plant Provided.—20 million c.ft. daily capacity.

Capital Investment to Outlet of Meter.—£450,000—Estimated at £22,500 per million c.ft. of daily capacity.

Cost of Carburetted-Water-Gas per se.

(Coke at 20s. per ton; Oil at 4d. per gallon)

—	Pence per 1000 C.Ft.	Pence per Therm.
Manufacturing Cost *less* Wear & Tear	12·43	2·49
Wear & Tear	1·40	0·28
Manufacturing Cost	13·83	2·77
Capital Charges at 10%* on £450,000 = £45,000 or	2·70	0·54
Total Works-Cost (to Outlet of Meter) of Carburetted-Water-Gas *per se*	16·53	3·31

The greater the percentage of Carburetted-Water-Gas, the nearer will its cost approach these figures.

* The same rate of 10% is taken for both Coal-Gas and Carburetted-Water-Gas, although the period of amortization is longer for Carburetted-Water-Gas than for Coal-Gas.

SUMMARY OF PART I.

Comparative Works-Costs, including Capital Charges

With 20% of Annual Output in the Peak-Load Portion (and 41% of C-W-G. in maximum day's output) and 80% of annual output in the Base-Load Coal-Gas Portion.

All gas of 500 B.Th.U.

—	Pence per 1000 C.Ft.	Pence per Therm.
Coal-Gas *per se*—		
Manufacturing Cost *less* Wear & Tear	10·60	2·12
Wear & Tear	4·00	0 80
Capital Charges	5·40	1·08
Works-Cost of Coal-Gas *per se*	20·00	4·00
Coal-Gas for Peak-Load—		
Manufacturing Cost *less* Wear & Tear	11·37	2·27
Wear & Tear	8·57	1·71
Capital Charges	12·73	2·55
Works-Cost of Coal-Gas for Peak-Load	32·67	6·53
Coal-Gas for Base-Load—		
Manufacturing Cost *less* Wear & Tear	10·41	2·08
Wear & Tear	2·86	0·57 +
Capital Charges	3 57	0·71 +
Works-Cost of Coal-Gas for Base-Load	16·84	3·37
Carburetted-Water-Gas for Peak-Load—		
Manufacturing Cost *less* Wear & Tear	12·80	2·56
Wear & Tear	1·50	0·30
Capital Charges	5·66	1·13
Works-Cost of C-W-G. for Peak-Load	19·96	3·99
Carburetted-Water-Gas *per se*—		
Manufacturing Cost *less* Wear & Tear	12·43	2·49
Wear & Tear	1·40	0·28
Capital Charges	2·70	0·54
Works-Cost of Carburetted-Water-Gas *per se*	16·53	3·31

CONCLUSIONS—PART I.

(See Works-Costs, including Capital Charges)

1. *Including Capital Charges,* Peak-Load Carburetted-Water-Gas as described herein costs 19·96d. per 1000 c.ft. or 3·99d. per therm, whereas Peak-Load Coal-Gas for similar duty costs 32·67d. per 1000 c.ft. or 6·53d. per therm.

In other words, such Peak-Load Carburetted-Water-Gas costs 12·71d. per 1000 c.ft., or 2·54d. per therm, *less than* (or three-fifths the cost of) the equivalent Peak-Load Coal-Gas!

2. *Including Capital Charges,* Base-Load Coal-Gas made jointly with Peak-Load Carburetted-Water-Gas, as described herein, costs 16·84d. per 1000 c.ft. or 3·37d. per therm; whereas the additional Coal-Gas to replace this Peak-Load Carburetted-Water-Gas would cost 32·67d. per 1000 c.ft. or 6·53d. per therm.

In other words, such Peak-Load Coal-Gas would cost 15·83d. per 1000 c.ft., or 3·17d. per therm, *more than* (or nearly double the cost of) the corresponding Base-Load Coal-Gas.

3. *Including Capital Charges,* Coal-Gas *per se* (which costs 20·00d. per 1000 c.ft. or 4·00d. per therm) divides into Base-Load Coal-Gas, costing 16·84d. per 1000 c.ft. or 3·37d. per therm, and Peak-Load Coal-Gas, costing 32·67d. per 1000 c.ft. or 6·53d. per therm.

Hence Carburetted-Water-Gas can be profitably used for "peak-load" service (to the extent of 41% of the maximum daily output as described herein) up to the cost of 32·67d. per 1000 c.ft. or 6·53d. per therm.

4. *Excluding Capital Charges,* the Manufacturing Cost of the Peak-Load Carburetted-Water-Gas (14·30d. per 1000 c.ft.) is less than the corresponding cost of the Coal-Gas *per se* (14·60d.).

This Manufacturing Cost of Carburetted-Water-Gas could reach 27·01d. per 1000 c.ft. (32·67 − 5·66 Capital Charges for Carburetted-Water-Gas), or *nearly double its actual cost* of 14·30d., before the Works-Cost (including Capital Charges) of the Mixed Gas would exceed such cost of the Coal-Gas *per se!*

5. Apart from the large "Reflex" Benefits to be outlined in Part II., the Net Annual Direct Savings *in this one Gas-works,* due to substituting only 20% of Carburetted-Water-Gas for Coal-Gas as described herein, amount to

$$800{,}000 \times (32{\cdot}67 - 19{\cdot}96) = £42{,}360!$$

It follows that the Peak-Load Portion allotted to Carburetted-Water-Gas should be far greater than 20%. With double that proportion, the *Direct* Annual Savings would be greatly increased; and, in addition, there would be corresponding increases in the large "Reflex" Benefits to be outlined in Part II.

(To be concluded.)

Analysis of Coal Ash.*

Fuel Research Survey Paper.

In connection with the physical and chemical survey of the national coal resources, the Department of Scientific and Industrial Research has issued a Fuel Research Survey Paper dealing with the methods of analysis of coal ash. This report, it is stated, does not purport to be a treatise on the subject, but is put forward—in the absence of any recognized scheme for the analysis of coal ash—in the hope that it will form a basis upon which to build a complete collection of methods for all types of coal ash and all constituents that may occur in them. To this end suggestions for improvements and extensions of the methods are invited.

Coal ash consists of a complex mixture of elements, mainly present as oxides (or, in combination with silica, as silicates), and generally some sulphates. The report deals with the determination of the commoner of these, which constitute the major part of most ashes. The methods described have been selected, after extended trials and with such adaptations as experience has shown to be desirable, from those already recognized for the analysis of silicate rocks and other materials similar in composition to coal ash. Methods are given for the separation and estimation of silica, iron, titanium, aluminium, calcium, manganese, magnesium, phosphorus, alkalis, and sulphur trioxide. Of these, the precipitation of titanium by "cupferron" solution is an interesting example of the newer practice—which seems likely to be increasingly adopted in the future—of employing organic reagents in place of inorganic reagents.

In addition to these major constituents, there occur smaller and variable amounts of constituents which may have an important bearing upon the properties and uses of the coal. Methods for the determination of some of these are still under investigation and are therefore not included in the report.

Many other elements, some of them classed with the rare elements, have been detected from time to time in coal or coal ash, and an appendix gives a bibliography of reported occurrences of these. Formerly their presence was mainly a matter of purely scientific or academic interest, but in view of their possible action as catalysts in certain processes of coal utilization (*e.g.*, hydrogenation) their detection and determination have recently assumed considerable practical importance. Since they occur generally in small amounts—often as mere traces—this is likely to be a matter of considerable difficulty, but the report states that the progress already made in spectrum analysis indicates that this may prove a satisfactory and rapid method of determining not only the presence but also the amounts of certain of these elements.

* Fuel Research, Physical and Chemical Survey of the National Coal Resources, No. 28, Methods for the Quantitative Analysis of Coal Ash. Published H.M. Stationery Office; price 6d. net.

PRODUCER-GAS FIRED SETTINGS

Automatic Combustion Regulation

A combustion indicator for producer gas and an automatic regulator of the primary : secondary air ratio are described by Giulio Alliata in *Monatsbulletin des Schweizer. Vereins von Gas- und Wasserfachmännern*, 1933, 13, 144-146 (June).

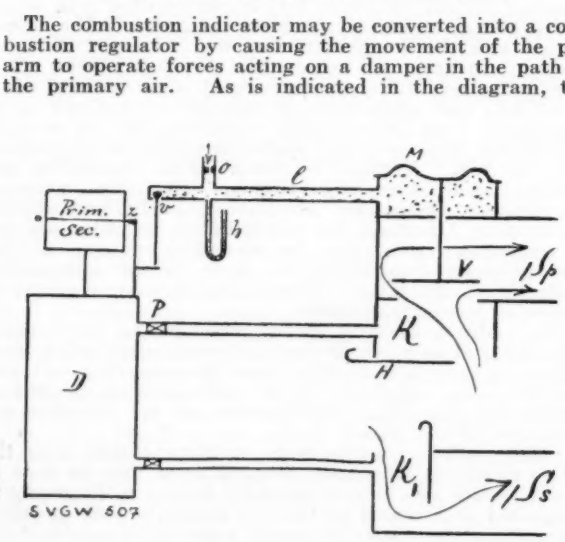
The Combustion Indicator.

Although, in producer gas-fired settings, the draught in the setting or chimney suffers but relatively slight variations, combustion conditions are generally liable to periodical fluctuations, since the ratio of secondary to primary air, which should remain constant, varies periodically due to changes in the resistance in the producer caused by formation of clinker, consumption of coke, and charging. Moreover, each change, even though small, in the primary air, gives rise, inevitably, to a variation in the secondary air. Hence, combustion conditions oscillate periodically between excess of gas and excess of air, and this reacts unfavourably on the throughput and temperature of the setting.

The reciprocal and relative effect of the primary air on the secondary air provides a practical means of determining their ratio with the help of a differential manometer. If the manometer is connected, once the proper ratio is attained, to two points in the path of the air suitably chosen such that they show the same pull, the pen of a recorder will move to one side or the other of a zero line when the ratio alters. The differential manometer thus becomes a combustion indicator and clearly shows the variations occurring as a result of variations in the resistance of the producer. The zero line is thus a guide and, if the primary air damper is suitably regulated to keep the pen on the line, the correct ratio of secondary to primary air is maintained. Hand operation is, however, laborious and is not sufficiently exact. The system of regulation described below has been successfully applied to a setting of 5 and a setting of 7 horizontal retorts.

Automatic Regulation of the Air Ratio.

The combustion indicator may be converted into a combustion regulator by causing the movement of the pen arm to operate forces acting on a damper in the path of the primary air. As is indicated in the diagram, the



manometer is connected to two chambers KK_1 situated in front of the primary and secondary air inlets Sp and Ss. The pull in these two chambers is equal if the air ratio is correct, and the pen Z will be on the zero line. The valve *v* allows an operating fluid (gas or air), which enters by way of an orifice O in the pipe *l*, to escape. When primary air is in excess, the pen rises, and the valve *v* opens more fully and allows more of the operating fluid to escape, whereupon the membrane M falls and carries with it the damper V. The volume of primary air is thus reduced and the pen returns to the zero line. The converse occurs if the secondary air is in excess. The result is that the pen remains on the zero line practically continuously.

The device does not complicate the operation of the setting since the latter is controlled in the usual manner —*i.e.*, the hand-operated primary air damper H is adjusted so that the secondary air gives rise to complete combustion of the producer gas. The combustion regulator then maintains the ratio of primary to secondary air, thus established, at a constant value within the limits of the reserve of draught of the regulating damper V.

When this reserve has been used up, the pin leaves the zero line, and the carbonizing man is warned that it is time to clinker or to rod the fire.

The maintenance of a constant and correct air ratio brings with it many advantages, including an economy in fuel. Other economies in the cost of fuel are realized in view of the possibility of spacing out the clinkering periods quite apart from the fact that lower grade material (breeze) may be admixed with the fuel. The temperature of the setting shows smaller variations and operation is more certain and more easy especially in the neighbourhood of peak temperatures.

It has been found that a pull of $\frac{1}{50}$ in. W.G. in the chamber K is amply sufficient, since the sensitivity of the arrangement is such that variation of $\frac{1}{2500}$ in. W.G. suffices to cause the regulation of the primary air to come into play. This great sensitivity is due to an appropriate design of the valve *v* and of the differential manometer. In spite of this great sensitivity, the primary air regulator is suited to the severe duty of the retort house, there being no guide mechanism and no stuffing-box. The low resistance of the arrangement enables the setting to be worked with a smaller pull than that required to flatten out the pressure variations in the interior of the producer. This reduced pull reacts favourably on the fuel consumption.

The operating fluid need have but a pressure of 4 in. W.G., its consumption being slightly less than $\frac{1}{2}$ c.ft. per hour; hence, if compressed air is not available, gas may be used. Where necessary, the gas may be injected by an appropriate device.

The pressure below the membrane M—*i.e.*, the extent to which the control damper V is opened—may be read on the manometer *h*; hence, at all times, it is possible to see how much reserve draught is available at V, and the plant can be run at the minimum pull.

Automatic regulation renders it more easy to control the working of the setting and the adjustment of the temperature.

(1) *Control of the Working of the Setting.*—If valve P of the differential manometer is closed, the pen will record the pull in chamber K_1 and will thus give an indication of the amount of secondary air. (Formerly, there was only an approximate knowledge of the amount of secondary air drawn in, since this depends on the position of the damper as well as on the pull in front of the damper.) If this valve is closed from time to time, it is possible to ascertain whether the pull corresponds to the correct amount of secondary air and, if need arises, to make adjustments to overcome, for example, an alteration in the pull of the chimney or an obstruction. The regulator then correctly adjusts and maintains constant the primary air. The more or less rule-of-thumb control exercised by the junior carbonizing staff is eliminated, and the responsible officials can operate the plant rapidly and exactly.

(2) *Temperature Regulation.*—The temperature of the setting is determined by the amount of secondary air. The possibility of exactly controlling the latter enables the temperature of the setting to be expressed as a function of the amount of air or of the pull in chamber K_1. If it is desired to alter carbonizing conditions, it is only necessary to make an appropriate adjustment to the secondary air damper. The regulator will then automatically adjust the primary air.

A further advantage of the system is that a record of operations on the producer is obtained—*e.g.*, the opening of the clinkering doors causes the pen to fall below the zero line. A similar, though smaller, effect is also ob-

tained when the producer doors are opened if the reserve of draught at V is almost used up. The recording of the operation of the setting is a feature which inspires the confidence and security of the staff. Though this is of secondary importance, it is sufficient, in itself, to warrant the installation of the regulator, the advantages of which may be summarized as follows:

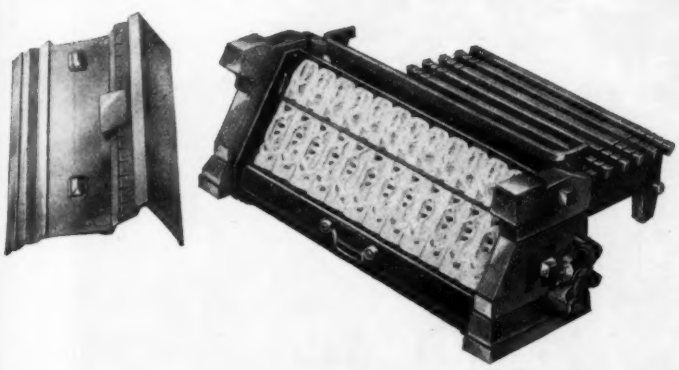
(1) Constant ratio between primary and secondary air. This gives rise to an economy in fuel sufficient to repay rapidly the cost of the regulator.
(2) Continuous control of the operation of the setting (air ratio and producer manipulations).
(3) Accurate, rapid, and convenient control of the carbonizing conditions.
(4) More constant temperature of the setting.
(5) Minimum draught.

In view of all these advantages, there should be no works without the device.

Where large variations in working conditions are required, the method of introducing steam must be modified so as to maintain a constant steam ratio. Alternatively, it is necessary to alter the ratio of primary to secondary air by hand adjustment of the primary air damper H.

NOTES ON PLANT AND PROCESSES

A Two-in-One Fire



The "C.C." Fire, showing cover (on left) removed from gas fire section.

The accompanying illustrations show the latest models of "C.C." combination gas or solid-fuel grate, manufactured by Messrs. J. Brockhouse & Co., Ltd., of Victoria Works, West Bromwich.

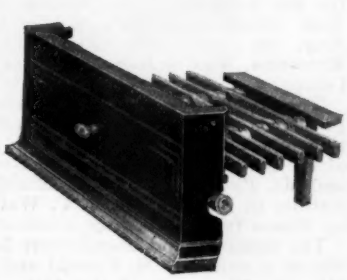
There are many advantages to be gained by the adoption of the "C.C." fire. The sales side of every gas undertaking has, doubtless, at some time or another—probably on many occasions—experienced the case of the householder who "must have a coal fire to sit by," although he is fully aware of the trouble, dirt, and inconvenience occasioned thereby, the difficulty of lighting, the time taken to burn up, and the uselessness of coal for short-period or intermittent heating. In the "C.C." fire the gas undertaking have a valuable "all-purpose" appliance with which to combat the coal-biased householder, at the same time obtaining a further load for gas which cannot do otherwise than lead to goodwill.

The "C.C." fire, therefore, satisfies those who insist upon having a coal fire; it also satisfies those who like the quick-heating of the gas fire in the morning for breakfast, but who prefer to sit by a coal fire when time moves more leisurely later in the day; and, finally, the fire may be used as a gas fire pure and simple.

The appliance, which is supplied in various sizes and in art black, black porcelain, armour bright, or chromium finishes, embodies, in the front, an efficient and economical inclined gas fire, with a consumption stated to be 2½ c.ft. per burner nozzle per hour. The gas fire is effectively shut in by a detachable cover, giving a neat appearance when not required or when the open fire is in use. Behind the gas fire is the patent grate bottom, easily adjusted to any shape of fire opening by means of adjustable swing legs, and fitted with a loose bottom which may be supplied suitable for burning any type of solid fuel. Also incorporated is a gas igniting burner which lights the solid fuel in a short time and dispenses with wood and paper. A special "duplex" tap is provided, which, in the upward position feeds the gas-igniting burner, in the downward position feeds the gas fire, and mid-way is off.

The smaller illustration is of the "T" model barless fire, which is designed particularly for burning coke, and embodies a gas-igniting burner. Like the alternative models, it may be fitted to most fireplaces without structural alterations. This grate is also supplied in black, armour bright, or chromium finish, and a 16-in. fire is stated to hold, on the average, 7 to 8 lbs. of coke, which will give a cheerful fire lasting three to four hours without attention, and costing but 4d. or 5d. a day.

Solid comfort from a glowing coal or coke fire, state the makers, and instant heat on chilly mornings, or whenever it is needed, from a bright gas fire, is veritably the last word in Comfort and Convenience—hence "C.C."



"C.C." Gas-Ignited Barless Fire.

Pickling Prior to Enamelling.

The production of good enamel ware necessitates the use of a pickling operation to ensure that the sheet iron which forms the base of the product shall be absolutely clean and that its surface shall be sufficiently etched for the enamel to grip the grain of the metal. In the factory of Messrs. National Enamels, Ltd., at Greenwich, a wide range of enamelled iron products required by the Gas Industry is produced with modern equipment operated under scientific control. High-quality sheet iron is employed, and after the preliminary shaping operations the iron is pickled in a cold solution of hydrochloric acid. The sheets are in the acid bath for approximately 20 minutes. This operation is followed by a water wash, the acid being finally neutralized in a weak soda bath.

Messrs. Henry Wiggin & Co., Ltd., Thames House, Millbank, S.W.1, inform us that Monel metal pickling crates have been used exclusively for four and a half years, and the original crates supplied, which are still in use, are in practically the same condition as when they were bought. These crates have been used continuously, for the plant is operated twenty-four hours a day. The importance of a proper pickling department was fully realized at the outset by Messrs. National Enamels, Ltd., and the choice of Monel metal made at that time was inspired by the fact that it was known to have been successfully used in contact with pickling solutions in many other industries. Their experience has been equally successful.

Enamelled iron components for a great deal of gas equipment sold in London and the provinces has been produced at the Greenwich factory. Similar components for geysers, slow combustion kitchen stoves, and other household equipment are also produced. The modern equipment installed and the careful technical control under which it is operated enable high-quality enamel ware to be produced by mass production methods and sold at correspondingly low prices.

THE "JOURNAL" TECHNICAL RECORD

Which contains Reports of Meetings of Gas and Allied Associations

Irish Association of Gas Managers

ANNUAL GENERAL MEETING AT WATERFORD

[*Photo. by Poole, Waterford*

PHOTOGRAPHED AT THE WATERFORD GAS-WORKS.

Waterford proved in every way to be an excellent place for the holding of the Annual Meeting of the Association, which took place in the City Hall on Tuesday, Aug. 15, under the Presidency of Alderman F. J. EDMONDS, who is Manager of the City of Waterford Gas Company.

The attendance was large, and among the visitors present were Mr. F. P. Tarratt, President of the Institution of Gas Engineers; Mr. E. J. Fottrell, Joint Manager of the National Gas Council of Great Britain and Ireland; and Mr. P. J. Lucas, of the British Commercial Gas Association, in place of Mr. J. C. Walker, who was prevented by illness from attending.

The members and friends were heartily welcomed by the Mayor (Councillor M. Cassin) and Sir Stanley Harrington (Deputy Chairman of the City of Waterford Gas Company).

The PRESIDENT said they were delighted to welcome Mr. Tarratt to Ireland, and hoped his visit would result in a continuance of the keen interest which the Institution of Gas Engineers were taking in the Gas Industry of Ireland. Unfortunately Mr. R. Bruce Anderson, the General Manager and Engineer of the Waterford Gas Company) was unable to be with them, and had sent the following telegram:

> "Wish you all success. Sorry absent.—Mr. and Mrs. BRUCE ANDERSON."

WATERFORD GAS SUPPLY.

Sir STANLEY HARRINGTON said that, in the unavoidable absence of the Chairman of the Waterford Gas Company, he had been asked by his co-Directors to come and extend a welcome to that very important visit of the Irish Gas Managers' Association. They met periodically in one place or another, and he thought it was a very long time since they had had a meeting in the beautiful city of Waterford. The Waterford Gas Company was a small concern of its kind, and they found it very hard to make much money at the present time. They had made great efforts to keep the Company going. They had met with numerous difficulties as a result of a terrible strike some years ago. They had always tried to treat the working people connected with the undertaking in a generous and loyal way, and in recent years they had responded to these efforts, and gave very good value for the fairly good wages they received. He hoped the Waterford people would realize the difficulties the officials had to contend with, including the tremendous competition of electricity. Electricity gave very little employment in Waterford; but every foot of gas produced gave employment in the city. He thought, therefore, they could look with confidence to the help of the local people, the traders, and the Corporation. Quite recently they had made arrangements for a supply of gas in connection with some of the building schemes, which would both serve the tenants and bring a little more grist to the Company's mill.

Mr. TARRATT said he heartily appreciated the kind welcome that had been extended to him, in his official capacity as President of the Institution of Gas Engineers, who regarded with the kindliest interest the doings of the various Associations, and not least of the Irish Association.

In England they were sometimes accused of holding too many meetings, but this could not be said of the Irish Association, who met only once a year. The programme before them that day was an excellent one.

Hearty votes of thanks were accorded the Mayor, Sir Stanley Harrington, and Mr. Tarratt, and to the Hon. Secretary and Committee. The President remarked that it was only upon taking the chair that one realized the invaluable nature of the work done by Mr. Airth on behalf of the Association.

PRESIDENTIAL ADDRESS.

Alderman EDMONDS then delivered his Presidential Address, which will be found on pp. 355-57 of last week's "JOURNAL."

Mr. L. G. YOUNG (Carlow) moved a hearty vote of

thanks to the President for his address, and it was carried with applause. He then, on behalf of the Association, presented to Alderman Edmonds the President's Medal, and expressed the hope that he would have many happy years during which to wear it.

The PRESIDENT, in acknowledgment, said the medal would always be a reminder to him of a very happy year of office.

LOSS BY DEATH.

The HON. SECRETARY AND TREASURER (Mr. George Airth, Dundalk), having acknowledged the vote of thanks to him, and assured the members that his services were always at their disposal, referred to the loss that had been sustained by the death of Mr. W. A. Reid, formerly of Longford, and subsequently of Malta, who was President of the Association in 1901.

Mr. W. E. YOUNG (Queenstown) said the late Mr. Reid was a model of all a man might be. He was an eminent engineer and a great gentleman.

It was resolved that a letter of condolence be addressed to the Secretary, and as a mark of respect the members stood silently in their places.

COMMITTEE'S REPORT AND ACCOUNTS.

Mr. AIRTH then read the following report of the Committee:

Your Committee have pleasure in recording that the Annual Conference for 1932 held in Dublin, under the Presidency of Mr. L. G. Young, Managing Director of the Carlow Gas Undertaking, was a great success. For the second year in succession, we welcomed the President of the Institution of Gas Engineers at our Meeting. It affords great satisfaction to us to know that the parent body is taking so keen an interest in our deliberations.

The members and their friends had the pleasure of being the guests of Mr. and Mrs. Young at luncheon, and the guests of the Carlow Gas Company, Ltd., at dinner. To both we extend our appreciation and thanks for the enjoyable time spent. Mr. C. W. Surman (Ballymena) and Mr. F. G. McElwee (Coleraine) contributed very interesting papers, which, in turn, were healthily and instructively debated.

Your special attention is requested regarding future ballot papers. Few members avail themselves of the opportunity of expressing their wishes in the ballot. Members should remember that they have the right to nominate anyone they wish whose name appears on the subscribers' list for election to the Committee. Such nominations, however, must be received by the Secretary before March 31 of any year.

The emergency duty which was put on coal has, by virtue of the latest Budget, now become a permanent duty. How long this imposition will last is not known, but we do trust the Government will soon realize the hardships the Gas Industry is caused to suffer from such a heavy duty, and in consequence will so alter the law as to give relief in this direction. Your President and Secretary were deputed by us to wait upon the Minister of Industry and Commerce, to discuss matters relating to the duties placed upon coal, cookers, steel tubes, malleable iron tubes, and tar.

Coal.—At an interview it was pointed out to Mr. Connolly (who deputised for Mr. Lemass) that coal to a gas undertaking was raw material from which gas was abstracted, and that the whole treatment was of a chemical nature. It was also pointed out that others were allowed a percentage of British coal to enable them to conduct their business as they could not work efficiently without it.

No reply was received with regard to the concessions to other business concerns *re* a fixed percentage of their coal requirements being British coal imported free. The Minister pointed out that a licence for free importation of cargoes of coal in transit was given at the date of the imposition of the emergency duty, but this was not dealing with the present conditions.

Cookers.—It was suggested that ovens of cookers should be allowed in free of import duty, the rest of the parts coming in separately to be attached here. The difficulty of utilizing local labour for fitting doors of cookers, on account of its being experts' work, was pointed out; it being imperative that they should be perfectly fitted. It was also suggested that tinware used in connection with gas cookers should be free of duty, as it was impossible to get them made in Dublin even as cheaply as the imported articles *plus* duty.

The Minister sees no reason why a complete assembling of such cookers should not be done in the Saorstat, and he understands that a Company is prepared to undertake the assembling of gas cookers for all gas companies in the Free State. The Minister therefore regrets that he cannot recommend a licence for the free importation of these articles.

Steel Tubes and Malleable Iron Tubes.—The emergency duty has been taken off these in the Budget.

Tar.—The British Government having put a duty on imported tar, it was asked that a subsidy of one penny per gallon be allowed to those gas-works in the Free State who exported their tar to Northern Ireland to enable them to carry on.

We received correspondence from the Ministry of Industry and Commerce in reply to the interview, and submit a summary of same for your consideration.

It was pointed out that, as the amount of tar exported was so small, there was no case whatever for a bounty on export.

Though your President and Secretary had a further interview, no good came of it.

Accounts.—The balance to credit in the Treasurer's hands this year is £137 5s. 10d., as compared with £123 3s. 6d. in 1931. The Buckley Fund is now disposed of.

In the unavoidable absence of the Auditor (Mr. L. P. Phillips, of Dublin), Mr. Airth summarized the balance-

[Photo. by Frank Phillips, 8, The Mall, Waterford.

OUTSIDE THE CITY HALL AT WATERFORD.

The Mayor has on his right hand Sir Stanley Harrington and Mr. F. J. Edmonds; and on his left hand Mr. F. P. Tarratt, Mr. George Airth, and Mr. J. M'Nicholl.

sheet, and on the proposition of the PRESIDENT, both report and accounts were unanimously adopted.

REPORT OF THE DISTRICT REPRESENTATIVE ON THE COUNCIL OF THE INSTITUTION OF GAS ENGINEERS.

Mr. AIRTH next read the subjoined report by the PRESIDENT in the capacity of district representative on the Council of the Institution of Gas Engineers.

As your District Representative on the Council of the Institution of Chartered Gas Engineers, I have pleasure in reporting that I attended eight meetings held in London, Birmingham, and Liverpool on various dates.

There is one important matter which I feel it is very desirous should be brought to your specific attention. Your Committee were of the opinion that Ireland should be represented on the Council, not by virtue of district representation alone, but by having one of its members on the Ordinary Council List. The viewpoint taken was that it takes a district representative, who usually serves for one year only, practically the whole of that time to become acclimatized to the atmosphere of such meetings. Then, when he might possibly prove of special service, his turn of office expires, and a new representative is appointed, who, in turn, has the same experience. Such conditions are, naturally, not conducive to the best interests of Ireland being served on this Council.

The Committee's opinion was expressed at one of the Council meetings, with the result that the Executive Council Committee very considerately recommended to the Council one of your members as their nominee for the consideration of Institution members in the ballot list submitted at the Annual General Meeting. Unfortunately, the election did not materialize, but it is felt we might confidently leave the matter in the hands of the Executive Council, fully assured that they will again deal with it in due course. I would, however, ask all the members present to agree that a special vote of thanks be forwarded to the Council of the Institution of Gas Engineers for their kindly action in this particular matter.

In conclusion, I would like to strike a personal note by extending my humble appreciation of the great honour conferred on me by the Council, and to say how very much I regret severing my association with so admirable a body. I would also like to have placed on record my deep appreciation and fullest thanks to the Directors of the City of Waterford Gas Company and to Messrs. Anderson Bros., for so kindly permitting me leave of absence in order to attend the meetings of the Institution. Such gestures on their part are a sure indication of their earnest desire to do all in their power to further the interests of the Gas Industry.

The report and the vote of thanks to the Institution Council were unanimously agreed to.

Mr. TARRATT said he had listened with great interest to the account which Mr. Edmonds had rendered of his stewardship. Mr. Edmonds had proved himself to be an extremely useful member of the Council. The point he had raised in the report about district representatives being on for only one year was receiving serious consideration.

On the proposition of the PRESIDENT, seconded by Mr. J. M'NICHOLL (Cork), it was resolved that Mr. J. L. Hyslop be the District Representative on the Institution Council for 1933-34.

OFFICERS FOR 1933-34.

The Scrutineers who were appointed to go through the ballot papers (Messrs. W. Cole and Keen) reported the election of the following officers for the ensuing twelve months:

President.—Mr. J. L. Hyslop, Belfast.

Vice-President.—Mr. J. A. Rooney, Drogheda.

Members of Committee.—Messrs. A. S. Brook, Lisburn; J. Walsh, Balbriggan; and J. W. Young, Queenstown.

Auditor.—Mr. L. P. Phillips, Dublin.

Secretary and Treasurer.—Mr. G. Airth, Dundalk.

THE PAPERS.

Two papers were read and discussed at the meeting:

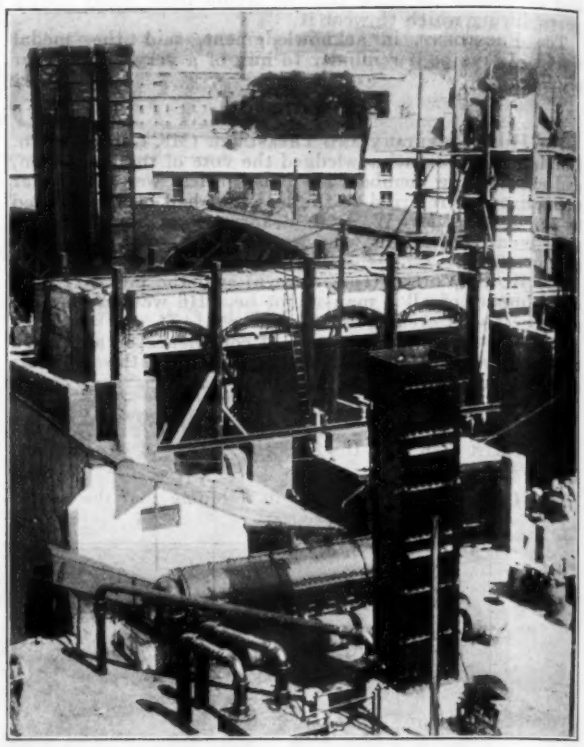
Mr. A. LAW (Limerick), on the "Flexibility and Running Costs of Vertical Retorts."

Mr. J. W. YOUNG (Queenstown), on a "Straight Line of Quality, and Increased Yield in Therms per Ton (with Reflections on Tar Firing)."

The papers and discussions follow this report.

AT THE GAS-WORKS.

At the conclusion of the morning session, members and friends were entertained by the President and Mrs. Edmonds, who kindly provided light refreshments. There was then an inspection of the prettily-situated gas-works and the President's well-stocked flower garden. At the moment extensions of the carbonizing plant are being carried out by Messrs. Anderson Bros., so that the visit proved especially interesting.



Extensions to the carbonizing plant at the Waterford Gas-Works comprise four beds of eight Sugden oval retorts, operated by pusher machinery, and allowance has been made for further additions at a later date, it being anticipated that another two beds will be put down next year.

IRISH DISTRICT EXECUTIVE BOARD OF THE NATIONAL GAS COUNCIL.

The Twelfth Annual Meeting of the Irish District Executive Board of the National Gas Council was held in the afternoon, and was of a private nature, for the discussion of matters of current interest. Mr. J. Ronan, Secretary of the City of Waterford Gas Company, one of the Vice-Chairmen of the Board, took the chair at the meeting. In the unavoidable absence of Mr. H. W. Saville (Wexford), Hon. Secretary, Mr. E. J. Fottrell acted as Secretary of the meeting.

The minutes of the meeting held in Dublin on Aug. 16, 1932, were read, confirmed, and signed, and it was reported that no alteration had taken place in the membership of the Board since the previous meeting. The membership list was taken as read.

Mr. J. D. Smith (Belfast) was unanimously elected Chairman for the ensuing year, and Messrs. W. J. Grey (Dublin) and J. Ronan (Waterford) were unanimously elected Vice-Chairmen.

The following members were appointed to the Managing Committee: Messrs. G. Airth, R. B. Anderson, W. J. Grey, A. Law, R. Healy, J. M'Nicholl, B. Mitchell, J. O'Flaherty, J. A. Rooney, J. D. Smith, and G. Walmsley; and the following were appointed representatives on the Central Executive Board: Messrs. R. B. Anderson, W. J. Grey, J. M'Nicholl, and J. D. Smith.

It was reported that Mr. H. W. Saville, Hon. Secretary, had intimated his desire not to submit his name for re-election. His resignation was accepted, with regret, and on the motion of the Chairman, Mr. F. J. Edmonds (Waterford) was unanimously appointed in his stead.

At the conclusion of the formal business, Mr. E. J. Fottrell, Joint Manager of the National Gas Council, spoke of the value of the work of the Council to all gas undertakings, wherever situated, and whether large or small, and expressed the view that the advantages accruing to the smaller undertakings greatly outweighed the annual subscription.

Mr. P. J. Lucas, who, in the absence of Mr. J. C. Walker, spoke of the work of the British Commercial Gas Association, expressed the desire of the Association to assist still further their Irish members, but he pointed out the need of closer co-operation between Ireland and the headquar-

ters of the Association in the framing of a policy of publicity and propaganda.

Dinner in the City Hall.

In the evening, by the kindness of the Chairman and Directors of the City of Waterford Gas Company, members and friends dined in the City Hall. We are assured by the local Press that the dinner was one of the most brilliant and successful functions of its kind that has been held in the city for some years, and certainly it was a memorable occasion in the annals of the Association. There were present the Mayor of Waterford and some 140 delegates and friends. Sir Stanley Harrington, who was in the chair, proved himself an excellent host. The speeches were interspersed with some well-rendered vocal items, contributed by leading Waterford concert artistes, including Miss E. Downey, A.R.C.M., Mr. W. A. Watt, and Mr. James Croke. The accompaniments were played by Mr. Hodgson and Mr. T. Cooney. Dinner was followed by dancing, which proved equally enjoyable, and was kept up until the early hours of the morning.

Following upon the toast of "Ireland," which was submitted from the Chair, Sir Stanley went on to propose "The Prosperity of the City and Harbour of Waterford." He said that he and his colleagues on the Board of the Waterford Gas Company were extremely glad to have this opportunity of showing their appreciation of the Association's visit to the city, and of the facilities placed at their disposal by the Mayor. What they wanted in Ireland, he went on to remark, was industrial development, but this could not be secured without individual effort. It was no use talking of starting industries unless the people clamouring for them had some sound schemes in their minds.

In the course of his reply, the Mayor referred to the prevailing depression, and expressed the hope that when next the Association visited the city they would find that prosperity had returned. He thanked the Gas Company for their splendid hospitality.

Proposing "The Gas Industry and Kindred Associations," Mr. G. W. Anderson emphasized the fact that, as compared with its principal competitor electricity, the Gas Industry is a big employer of labour. This the Government should take into account.

A Little More Driving Power Needed.

Mr. F. P. Tarratt, replying on behalf of the Gas Industry, said he felt they could look forward to prosperity. There appeared to be a feeling of pessimism prevailing in Waterford and the Irish Free State generally, but there was no real cause for this. It was useless to bemoan the advent of electricity, which was with them, and was going to stay with them. It was up to the Gas Industry to do the best it possibly could with the product which it produced. A little more driving power was needed in seeking customers, who could be found, if they went the right way about looking for them. It was essential that they should have the right type of men to search out this business. They had at hand a powerful ally in what was termed the "cooking load." There was no one who took greater care in seeing that she got good value than the frugal housewife, and they should be able to place before her an irresistible case in favour of gas, which, in addition to being "good value," was thoroughly reliable. There was also plenty of other business to be secured, with the aid of attractive tariffs. But it must be sought, and sought vigorously. They had that morning listened to a very excellent address from the President, who had shown them that he was certainly not a pessimist.

Mr. E. J. Fottrell, responding for the Kindred Associations, stressed the advantages of co-ordination and co-operation, and declared that there was a much greater future before the Gas Industry than anything that had been accomplished in the past.

Mr. J. W. McLusky, who also replied, said he was present representing the North British Association of Gas Managers, and he extended to those present the greetings of Scotland. He deeply appreciated the real Irish hospitality that had been extended to the visitors.

The next toast was "The President," proposed by Mr. J. M'Nicholl, in pleasing terms, and replied to by Alderman Edmonds, who expressed his indebtedness to the Directors of his Company and to Messrs. Anderson Bros. He also thanked his staff and the employees generally for their loyal support, which was essential to the success of the meeting.

"The City of Waterford Gas Company" was in the hands of Mr. M. S. Breene, President of the Chamber of Commerce, and was responded to by the Chairman, who said the Directors wished to return their sincere thanks to Alderman Edmonds, his staff, and all the workers, for having helped them to make the undertaking what it was to-day.

The remaining toasts were, "The Ladies," proposed by Col. Glover, and acknowledged by Mrs. Edmonds and Mr. P. J. Lucas; and "The Press," which was submitted by Mr. J. L. Hyslop.

Golf Competition.

With the exception of the Golf Competition for the Grant Cup, there were no set arrangements for the following day, as it had been found impossible to secure facilities for the usual excursion. Many found their way to Tramore, whose natural attractions were added to by a Race Meeting.

Vertical Retorts for Ireland*

By A. Law, M.Inst.Gas E., Engineer and Manager of the Limerick Gas Undertaking.

Perhaps an apology is due to the members of the Association for bringing up once more the subject of vertical retorts, because it is one which has been dealt with on several previous occasions at meetings of the Irish Association. My defence is that, in the first place, I claim a more varied experience of vertical retorts than perhaps any other member of the Association, and, in the second place, I am by no means sure that the subject has been exhausted. Immense progress has been made in very recent years in the development of high-temperature carbonization in general and of the continuous vertical in particular. This apparatus has been modified repeatedly in the direction of coping with the varying situation in the demand for gas and the development of the appliances using it, as well as with the varying markets for bye-products and the influence of the carbonizing plant upon their nature and properties.

The continuous vertical retort has proved that it is susceptible to modification in design to deal with whatever changes may be necessary to adapt it to differing requirements. By this I mean to convey that, whatever may be the situation in a particular district, whether the demand be for a maximum gas output, for gas of high or low calorific value, for maximum or minimum coke productions, for the production of tars suitable for road making or other purposes, the continuous vertical retort can be adapted to meet the situation whether for large or small works.

This statement is not in the nature of a prophecy, it is based upon the results of past experience.

The Gas Industry is in a position to satisfy the interesting developments which are taking place in the demand for reliable, clean, and cheap fuels—gaseous, liquid, and solid. It is an Industry which has not waited for Government subsidies and backing, but which, in spite of inspired utterances of highly placed personages in its disfavour, is "getting on with the job" and is to-day offering the public what they want for every domestic and industrial purpose where heat is required in an easily controllable and readily applicable form. And it behoves the gas manager to explore the design and performances of plant which enables him to meet this rapidly growing demand in the most economical and most readily controllable manner. Particularly in a country where every ton of fuel must be imported it behoves every good citizen to exploit those systems of coal treatment which produce the maximum effective supply of fuel for the consumer with the minimum tonnage of coal import.

The Gas Industry produces, I claim, the fuel which is the cheapest, not only in the immediate present, but in the long run. It gets the most out of every ton of imported coal, it employs directly and indirectly a greater number of technically skilled and unskilled men than any other industry supplying power and heat to the public, it receives no special advantages from the Government, and yet it renders its service to the public, pays its dividends, and, in cases where undertakings are owned by municipalities, contributes substantially to the relief of rates, meets its

*A paper read to the Irish Association of Gas Managers at Waterford on Aug. 15.

obligations with amazing regularity, and so stable is its position that gas stock is reckoned among the gilt-edged securities.

I have prepared these notes mainly with the idea of stimulating your interest in the most recent developments of carbonizing plant, with most of which I have been personally connected, and in their bearing upon the future requirements of the Industry.

Design.

Mr. Blundell, of Carlisle, who was one of the very first in the field with the modern process of steaming in continuous vertical retorts, which has made such a revolution in retort house practice, has already pointed out in an inspiring address he gave to the Cumberland and Westmorland Association in September, 1929, that the technical efficiency of a small gas-works can be quite as high as that of the very largest. There is no need to wait for amalgamations and so-called rationalization, whatever that mysterious word may mean, before installing plant which will give the maximum efficiency immediately.

There is a further point. It is not generally realized how readily and how perfectly the continuous vertical retort can be adjusted to meet all classes of coal. My undertaking, in common with many in this country, has been obliged to turn over from coal obtained from Britain to that obtained from the Continent—a complete change in the properties of the coal. The change-over has been effected without the slightest trouble or inconvenience, and without the slightest interruption in the production of gas at the declared calorific value.

But far greater changes in the conditions of operation can be effected than that. It is well known that the market and demand for coke can vary very considerably in the same district. The vertical retort can be operated to make little or much coke, and the output of gas can be varied to meet sudden demands with very little warning indeed. The mere adjustment of speed and throughput and quantity of steam admitted is sufficient to effect the necessary alteration in the working.

Much has been said about high and low temperature carbonization. During the war period the late Mr. John West showed that he could operate the continuous vertical retort at temperatures ranging from 1400° C. to 1000° C., and even lower. Not that he believed, and not that I believe, that there is any advantage whatever in working at low temperatures. I believe that the future of the Gas Industry lies in the direction of working at temperatures as high as the refractory materials will stand, consistent with maintenance costs. Indeed, one reaches a point where it is doubtful whether it would not pay to obtain a high yield of gas for a comparatively short period rather than be content with moderate yields for a long period. It is a ques of finance.

Maintenance.

Mr. Buckley, late of the Manchester Gas Department, showed, in an exhaustive study he made of a continuous vertical retort plant which he operated at Droylsden for eleven years, that the maintenance cost of that plant was very much below anything that can be shown for any other type of plant doing the same work. This was largely due to the character of the plant. In a continuous vertical retort plant the mass of brickwork for the same duty is relatively small, the machinery is of robust design, simple in construction. and slow in motion. There is very little to wear out. Comparing the figures with my own, I had to make some reductions. Mr. Buckley included items which, to my mind, are not strictly maintenance figures at all. For example, he included oil for his gas engines, gas used in the engines, and similar items. Deducting these and modifying the figures generally according to my own ideas, I find that Mr. Buckley had a maintenance cost of 5·36d. per ton of coal handled over that period of eleven years.

In the six years during which we have been working with verticals in Limerick we have carbonized about 48,000 tons of coal, and the total expenditure on maintenance has been something like £431, or less than 2¼d. per ton of coal carbonized. Of course, we still have to face a re-setting, but there seems to be no reason why we should greatly exceed Mr. Buckley's figure.

Flexibility.

The ease with which the vertical retort can be slowed down and speeded up is one of its greatest advantages. I have known cases where holder capacity is short and where difficult situations have been satisfactorily dealt with, solely because the output of the vertical retort can be reduced to one-half its normal capacity within a few hours, and increased beyond it with equal facility by very simple mechanical manipulation. And this can be done without detriment to the constant quality of gas produced, and without any ill effect on the bye-products.

Perhaps some of the most striking features of districts served by continuous vertical retorts is their entire freedom from naphthalene. Complaints from this source simply disappear.

The coke produced in verticals is admirably adapted to domestic and industrial uses. "Vertical coke," as it is called, is equal to any of the low-temperature products which are so extensively advertised in some directions, from the point of view of smokelessness, and it can be consumed in the open grate without any trouble whatever. One of its properties is its refusal to become water-logged. Coke which is produced in horizontal retorts and water-quenched will not burn in the fire without spitting and flying. "A piece of vertical coke," says Mr. Buckley, "may be dropped into a bucket and left there for half-a-day, and yet it would not get 5% of water into it." In short, vertical coke fills the bill for a smokeless solid fuel which can be consumed in the open grate without polluting the atmosphere.

Some idea of the effect of the installation of vertical retorts can be obtained from the results of the year 1924 compared with those for the year 1932-33 in my own undertaking.

The principal recorded figures are as follows:

—	1924. Horizontal Retorts.	1932-33. Vertical Retorts.
Gas made, c.ft.	116 500,000	127,000,000
Coal carbonized	Yorkshire	Westphalian
" " tons	9749	7900
Coke sold "	4230	3522
Breeze sold "	323	375
Tar made "	377	620
Carbonizing labour cost	£7962	£3718
Works maintenance.	£3120	£1293

On the technical side the figures speak for themselves. On the financial aspect it should be stated that in the year 1932-33 we paid out £1910 in the form of pensions, whereas no expenditure under this heading was incurred in 1924. During the years 1930-31-32 over £5000 was expended out of revenue for repairing and relaying gas mains and services. And, further, the price of gas has been reduced 5%, with discounts up to 20%, which would not have been possible if the old system had been retained.

With regard to the item "Works Maintenance," this includes an annual sum of £140 which is laid aside for re-setting. Actually, as I have already stated, no more than £431 has been expended on repairs and maintenance of the vertical retort installation with its ancillary coal and coke handling plant.

Distribution.

Gas distribution in a sparsely populated country, such as we have in some parts of Ireland, presents some unique problems. It is true that the transmission of gas by long pipelines with no large demand on the way is not an economical proposition. But recent years have produced a solution of these problems. I refer to bottled gas.

The use of bottled gas has been rendered possible by recent developments in the technique of the alloy-steel industry. Cylinders have now been manufactured for some years in alloy-steel which will not only stand with safety pressures of 200-250 atmospheres, but which, when tested to destruction, merely split and do not fly into fragments.

This development, in its modern form, emanates from Paris, where gas was supplied from the Gas Company for use in the kitchens of express trains to the coast. But during the last five years high-pressure gas in cylinders has been applied to road vehicles, of which several have been running in Paris for a considerable period, while several of the cities in England have experimental vehicles on the road. Fuel-cost per mile is shown to be less than with petrol, including all costs of compression and storing. It is true that supply stations have to be provided, but this presents no difficulty in the case of motor 'buses and other vehicles travelling over a constant route.

The application of this system to the supply of outlying houses, farms, villages, and even the smaller townships, is obvious. The cost of the cylinders and of compression is not greater than that of consumers' meters, services, and maintenance, while the cost of carriage can be set against boosting costs and capital charges on long-distance mains, so that gas can be supplied in these cases at prices which will certainly compete with electricity or oil.

Conclusion.

Expenditure upon remunerative enterprise is the wisest form of economy. The world is suffering to-day from frozen capital. We in the Free State of Ireland have a golden opportunity to apply some of this idle wealth to the improvement of the amenities of our people, cleansing the atmosphere of our towns and countryside, bringing

scientific method to the solution of all problems of heating, cooking, and water heating, and, at the same time, paying a reasonably safe interest on the capital invested. Ours is, largely, a scattered population, but I am convinced that the use of bottled gas in conjunction with the continuous vertical retort, owing to its great flexibility and ready adjustability to fluctuating demands, will enable us to place gaseous fuel at the disposal of practically every family and industry in the country.

I have said nothing about sales policy, but I will conclude with one remark on that subject. There is need for energy and ingenuity in bringing the qualities of our wares to the notice of the public and pushing the sales of them by all suitable methods, but nothing of this work will be lastingly effective unless we can produce them at competitive prices and maintain their quality at a high and constant level. That, I am convinced, can be done, in the first place, by the installation of the continuous vertical retort. It still remains true, as Thomas Newbigging said years ago, that any want of economy in the retort house cannot be compensated for in any of the subsequent stages or processes to which the gas is to be subjected, or through which it has to pass (and this to my mind includes the whole organization of distribution and sale), before it reaches the consumer.

Discussion.

Mr. J. M'Nicholl (Cork) said they were all aware of Mr. Law's experience with vertical retorts, and so were always glad to hear him on the subject, but in this paper he did not give them sufficient detail. The paper contained figures relating to Mr. Law's undertaking with horizontal retorts for the year 1924 and with verticals for 1932-33. Assuming the same gas quality, for horizontals the results were 54 therms per ton, and 8·7 cwt. of coke sold. This was a very unfortunate experience with horizontals, and when they came to the verticals, they had only 72 therms per ton, and 8·9 cwt. of coke, which was also not very good. He complimented Mr. Law upon his candour in bringing forward these figures, which he was quite sure Mr. Law did not hold out to be representative of either type of plant. Probably Mr. Law would be able to advance very good reasons for the figures being so low. Did the author practise steaming? To compare horizontals only with vertical retorts where steaming was practised would be hardly fair. In order to make the two systems strictly comparable, it would be necessary to include a water gas plant with the horizontals. He (the speaker) quoted some of his own figures showing a yield of mixed gas of 16,312 c.ft., of a calorific value of 502 B.Th.U., or 81·9 therms per ton of coal. This was a mixture of roughly 77% coal gas and 23% water gas. Making allowance for the coke used in the manufacture of water gas, the net yield of coke worked out at 8·6 cwt. per ton of coal. The gross yield of coke, without making this allowance, was, of course, much higher. He did not claim these figures as representative, and was sure that with a more modern plant still better results could be obtained. At the same time, he ought to point out that the labour costs in connection with a vertical retort installation where the two operations were combined should be very much lower.

The President on Peat.

Proceeding, Mr. M'Nicholl said he wished it might have been permissible to discuss the Presidential Address, because his own point of view was that the remarks of Mr. Edmonds on the subject of peat were too optimistic.

The President said he had no objection whatever to his Address being discussed, but he would like to point out that he had made it clear that a considerable amount of research work would be necessary before it could be used on gas-works. The only possibility he could see at the moment in this connection was its use as producer gas for heating up retorts.

Mr. M'Nicholl: Considerable research work has already been carried out, and the results have not been at all promising. Personally, I have very little hope of success. Continuing, the speaker said he would like to refer also to the remarks of the President and Mr. Law with regard to "bottled" gas. This proposition was in its infancy, and he would not wish anyone to think it was a proved success. Before incurring the expense of a compressing plant, it would be advisable to go very carefully into the matter. All engines might not be suitable for the purpose.

The Mania for Very High Makes.

Mr. J. L. Hyslop (Belfast) remarked that when first he entered the Gas Industry, which was now some fifteen years ago, he came into contact with the author, who even then was considered somewhat of an expert with regard to vertical retorts. Mr. Law had stated the case fully, and he agreed with practically all that he said. What interested him most was that the author showed a make of only 16,000 c.ft. per ton. This, of course, was from Westphalian coal, which was not nearly so good as Yorkshire or other English gas coals. On the other hand, he sold nearly 10 cwt. of coke per ton. It seemed to him (the speaker) that the mania for very high makes per ton was in most cases a mistake. He thought Mr. Law realized what some people did not—that so long as one had a good market for coke, it paid to be content with a moderate make of gas per ton, and to sell all the coke one possibly could.

Another thing which interested him, said Mr. Hyslop, was the reference by Mr. Law to "bottled" gas, because in Belfast they had just obtained authority to put down a plant for that purpose, and hoped to have it working within a few months. He felt, however, he could not share the author's optimism with regard to the supply of gas in this form to outside districts. At Belfast they had fixed a price of 3s. per 1000 c.ft., but they had a cost into holder of about 10d. per 1000 c.ft. When one considered that the compressing cost alone was going to be 6d. or 7d. per 1000 c.ft., he thought it would be agreed that small undertakings could not supply at anything like the figure he had named. A standard cylinder at the pressure contemplated would hold only about 1s. of gas at the Belfast rate. This cylinder would weigh about 1 cwt., and if it had to be carried any distance for use, the transport charges in proportion to the value of the gas were bound to be very heavy. But the greatest drawback was the capital cost that would be involved. If they were going to supply gas at these high pressures to their ordinary consumers, it was essential that with each bottle they should have a highly efficient reducing valve, and the cost of such a reducing valve to-day was between £15 and £20. To this one ought to add about £12 for the cost of the "bottle." Thus there would be a capital outlay of some £30 for supplying 350 c.ft. of gas, and he feared that this would prove prohibitive. It would, of course, mean a great deal to them if they were able to supply their consumers in this form.

Horizontals or Verticals.

Mr. G. W. Anderson (London) said that on three occasions he had had to consider the question of vertical retorts. Once they were debarred by capital cost, which was at that time just double that of horizontals. In the second instance, quite the contrary was the case. There had been an interval of five years, during which the capital cost of verticals had come down enormously, and was, in fact, less than that of horizontals with machinery. In one case he put up horizontals because he had plenty of room; in another case he erected verticals because he was restricted in area. This, to his mind, was the most important point in favour of verticals. With regard to working, he had an open mind. One had to consider all the circumstances. In these two cases the carbonizing wages (including boilermen, and all the usual men who attended to carbonizing) worked out at 0·504d. per therm for the horizontals, and 0·514d. per therm for the verticals. Where one had plenty of room, he thought one should go in for horizontals with machinery. With horizontals one could take any coal that was convenient; with verticals—with all due respect to Mr. Law—one had to exercise a certain amount of judgment with regard to the coal used. Where he had put in verticals, they were using Yorkshire nuts very successfully, but he could get Durham unscreened coal 6s. per ton cheaper than the nuts. He impressed upon the management the necessity of trying Durham coal, and he was met with strong opposition. But they decided to make the experiment with Durham coal (not run-of-mine coal), and the supposed difficulties disappeared. The only trouble was that they did not get the throughput required. The retorts could be used with a great variety of coals, but there were some which it was impossible to employ with verticals. At Waterford he had to consider the same question. The cost, again, of verticals was double that of horizontals, and the Waterford Company could not get the necessary capital. They were therefore putting in horizontals at half the cost, and he thought the Directors would be satisfied. Each one had to consider the question from his own standpoint. With hand labour, vertical retorts would be cheaper for working; but where one had plenty of room, he was in favour of horizontals with machines. Mr. Law did not go into capital costs, and that was what one had to consider. They should not be led away by ideas of fashion.

Hasten Slowly.

Mr. F. P. Tarratt (Newcastle-on-Tyne) remarked that Mr. M'Nicholl had made reference to the subject of "bottled" gas, for motor vehicles, &c., and had uttered a very necessary warning. They had been experimenting for twelve months in Newcastle, and there had been a good deal of trouble. It was found that what might suit one engine would not necessarily suit another. He did not wish to be pessimistic, but he thought they had still some distance to go before such a scheme could be considered an assured success. One should not act too hurriedly. The difficulties to be overcome were very carefully studied in the paper presented by Mr. Joseph E. White at the last meeting of the Institution of Gas Engineers; and those who took an opportunity of reviewing that paper once, or possibly twice, would probably moderate their views, and go slowly. There was also the question of taxation to be borne in mind. There might be a sort of levelling-up or levelling-down.

They had, Mr. Tarratt went on to say, had some interesting remarks from Mr. Anderson with regard to vertical and horizontal retorts. At Newcastle he (Mr. Tarratt) had two or three works to control, and he felt there was a good deal in the warning Mr. Anderson had uttered not to rush wildly for verticals merely because they were the latest fashion. With the improvements they had been able to bring about at Newcastle in their horizontal retorts, machine operated, the carbonizing costs were practically as good as with the verticals. So it was advisable to consider carefully before one went in for a very great change. With the introduction of silica retorts, which were now becoming general for horizontal retorts (as also for verticals), the life of the horizontal retort was going to be enormously extended. In fact, he did not know what was the life of a good silica retort to-day.

Continuing, Mr. Tarratt pointed out that in connection with carbonization problems each had his own case to consider. One

question would be: "Do you want coke or do you want gas?" Personally, he believed in a high-grade gas, but this assumed that there was a good market for coke. If coke was always going to have a ready market, they should make a good-class coke and a good quality gas, and if there was anything to spare—take it out in benzole. This was being done at Newcastle with great success. The plant was simple, and maintenance costs were low. They would have no difficulty in getting rid of the benzole, and the line on the calorific value charts would be improved—that was, of course, if they left a little benzole in the gas so as to be able to take it out.

THE AUTHOR REPLIES.

Mr. LAW, in the course of his reply, said he agreed with Mr. M'Nicholl that the yield from horizontals quoted in the paper was low, and the same was the case with the verticals. But he had a test every week from Saturday to Monday, and the latest test on Westphalian coal came out at a little over 20,000 c.ft. per ton, and the coke was reduced to slightly under 40%. So if they wanted to make gas they could do so. This proved the flexibility of the vertical retort. It had, for business reasons, been his aim during the last three years to supply gas of 460-465 B.Th.U. He found it was paying to do it. The figures in the paper were not entirely representative of what could be done. He had a very good market for coke, which was turned out dry, so that the consumer was getting absolute value for his money. Mr. Anderson's arguments were good.

The PRESIDENT remarked that they would have liked more details regarding costs, which would have given them something definite to go upon. For example, the cost into holder would be an interesting figure. He suggested that at some future date two members of the Association should combine to contribute a paper on horizontal and vertical retorts, in order to give them absolute, concrete figures in the matter of capital cost and cost into holder—in fact, putting before them practically a balance-sheet for a year's working.

The author was heartily thanked for his contribution.

A Straight Line of Quality and Increased Yield in Therms per Ton (with Reflections on Tar Firing)*

By J. W. YOUNG, of Queenstown.

To anyone possessing a recording calorimeter, the amazing and serious variations that can occur quite often in the calorific value of the town gas will be apparent, and I do not think there is any need for me to dilate on the bad conditions of service which such a supply produces on the district. Past experience has shown that variations of 7% or thereabouts can occur on the town under certain conditions, and, in my opinion, the most fruitful cause of this lies in the undue time lag of the test light—that is to say, its slowness in indicating a change of make quality.

In the majority of cases, on a small and medium size works, the test light gas when taken from the usual point—namely, the outlet of the purifiers—has a lag of upwards of half an hour, and, indeed, in one case that I heard of, over an hour elapsed before any indication was given that a change was necessary, and in that period quite a considerable amount of poor or over rich gas would have been made. On those works using a mixing holder, or one with the rise pipes widely apart, the effect of the oncoming deficient make is not so noticeable, as the gas has time to follow the natural law of diffusion and become mixed before passing to the town.

In our own case, we do not use a mixing holder, and, as the pipes of our main holder are close together, we found that during the hours of peak load, when the demand exceeds the make, the make gas is apparently drawn over and partly or wholly goes on the town. Indeed, a variation of 10 B.Th.U. on the make, for a period of 15 minutes, affected the issue later on to the extent of 8 B.Th.U. for a similar time. On the other hand, during Sunday afternoon, which, in most cases, is a period of the lightest demand, quite considerable variations could be allowed in the make without causing any noticeable difference in the issue.

REMOVAL OF TAR FOG.

The time lag evil can be effectively overcome by taking the test light supply direct from the exhauster outlet. At this point, the gas is heavily laden with impurities and tar fog, and, of course, some purification must be attempted before the gas is burned at the flat-flame burner. Having tried many different sizes and shapes of oxide purifiers, eventually I came to the conclusion that a simple miniature scrubber, filled with steel wool, was the most effective in the long run. Such a scrubber, of course, made no attempt to remove anything but tar fog; nor did the other impurities prove to be of any detriment in practice. The general arrangement of the pipes and scrubber is apparent from the sketch shown in fig. 1.

The scrubber is duplicated and one is kept immersed in tar oil ready for use immediately when required. Couplings are used, and the changing of a scrubber is the work of a few seconds. In running the gas from the exhauster outlet, it is better that the pipe be returned again to the exhauster inlet, or its equivalent, thereby removing time lag due to the pipe line itself by keeping the gas continually circulating.

At Queenstown, the effect of making these alterations was to reduce the time lag from 25 minutes to less than three minutes; and accordingly the stoker was able almost immediately to adjust his pull and the amount of producer gas added to avoid the sudden rush of rich gas occurring after a charge. Another point of advantage is that the manager is more easily enabled to keep an eye on the make and does not have to wait more than a few minutes at any time to see how things are progressing. A nearer approach to a straight line of make quality must, of necessity, tend towards a greater yield per ton of coal.

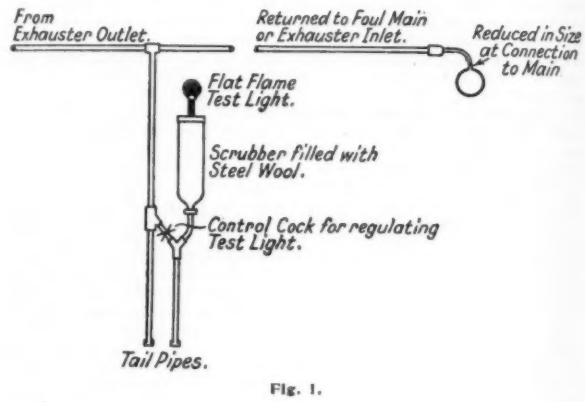

From Exhauster Outlet.
Returned to Foul Main or Exhauster Inlet.
Reduced in Size at Connection to Main
Flat Flame Test Light.
Scrubber filled with Steel Wool.
Control Cock for regulating Test Light.
Tail Pipes.

Fig. 1.

HYDRAULIC MAINS.

Modern retort house practice demands that if you must have seals they should be light liquor ones. Such light seals as are desirable, however, are by no means easy to maintain in practice, as those of you who have to make shift with an old retort house will know. To employ really light, or, for that matter, any type of seal it is necessary to have the hydraulic mains dead level and the dips of equal length, a top or side gas offtake, and possibly an anti-oscillation device. By far the greatest difficulty is that of mains getting out of level, and may I at this stage give you a few points on what evil results from this happening?

Assuming a dip of ½ in., a difference of ½ in. in the two extreme outside retorts means that a difference of 25% in pressure or vacuum is occurring, and that one or more retorts are being over exhausted while the others are working under an undue pressure, leading to waste of gas from leakage through the retorts and further losses due to over cracking of hydrocarbons with scurf formation. In the case of the over exhausted retorts, an undue amount of inerts being drawn in, stopped pipes occur, and, if the heats be high, a deposit will be formed in the main. Furnace gases, being of an oxidizing nature, at times on their passage through the pores of the over exhausted retorts quickly make the retorts still more leaky by burning out the carbon particles. Eventually, after a few weeks of working, the stoker is driven to reducing the vacuum to undesirable limits in an endeavour to keep the quality to the standard. This progressive reducing of vacuum over

* A paper read to the Irish Association of Gas Managers at Waterford on Aug. 15.

a period of a few months in the case of a new bed is usually attributed to the plant getting old.

To Abolish Seals.

Without going into chemical reactions, I think you will agree with me that the elementary points mentioned are serious enough. At Queenstown, realizing the advantages of light seals, we endeavoured to reduce them to an absolute minimum, and the results were so satisfactory that we decided to go a step further towards greater efficiency and abolish them altogether. We, therefore, made butterfly valves and had them fitted to the bridge pipes, and the seal was run off.

At this time the only governor we had was the usual exhauster by-pass butterfly type. The governor was adjusted to give level gauge at the mouthpieces of the retorts, the idea being to make straight coal gas and reduce to our 500 B.Th.U. standard by adding producer gas. The small amount of vacuum required was insufficient, however, to pull in enough producer gas to bring down the calorific value, so slight overpulling had to be indulged in. With the abolition of the seals, an immediate increase in the make was apparent, and at the same time stopped pipes almost entirely disappeared, while the CO_2 content of the gas dropped to an average of 2·8%, this figure, of course, being influenced largely by the amount of producer gas taken in; actually the straight coal gas contained but 2·3% CO_2.

After a week or two in use with dry mains, the butterfly compensator governor valve began to work stiffly, causing erratic control, and so an oil bath was rigged up to lubricate the gland, which proved most beneficial. We decided that a larger governor bell would be desirable for more sensitive working as the bed got older, and accordingly constructed a bell about 3 ft. in diameter, which, when mounted in a tank, proved so sensitive that we began to be troubled by the valve hunting, a fault which was eventually cured by making an oil damper consisting of a piston sliding in a tube filled with light oil. When we saw that results justified further consideration, a retort house governor was installed, which proved capable of responding to the extremely small degrees of vacuum required.

The usual type of " U " tube gauge proved useless, of course, for indicating the extremely small pressure variations, and so we had made up a single tube gauge of the inclined type graduated from a centre zero to read *plus* or *minus* ½ in. over a scale of 9 in., either side of zero, and filled with oil instead of water.

Producer Gas.

In connection with the drawing in of producer gas, I think it would be of interest were I to give you some observations as to the most satisfactory way of obtaining the gas. From a side producer, no difficulty at all will be experienced, as there will at all times be a plentiful supply of good gas. In the case, however, of the ordinary regenerative setting, in which an attempt is made to obtain the carbon monoxide gas from below the furnace arch, it may be found hard to get a good quality gas due to air leaking in through the producer charging door, producer wall, &c.

The usual method of controlling the heat in such a setting is, of course, a combination of adjustments of main damper, secondary air, and primary air slide. In many cases, closing the primary air slide to normal working conditions gives a negative pressure over the fuel bed, resulting in the drawing in of air through the small cracks present in the brickwork, upsetting both combustion efficiency of the bed and the quality of the producer gas. By far a better plan is to open the primary slide wider than usual and partially close the nostrils by means of bricks to a position which allows the required heat to be maintained in the setting. A pressure will then be present in the furnace, and no air can possibly be drawn in, while the gas will be as good as can be obtained from the depth of fuel in use.

With regard to the system of piping required, it is essential, for consistent working, that the gas be freed from dust before it enters the foul main. In our own case, the gas is taken from beneath the arch in the back end of the setting (in this respect I might say that when a good pressure in the furnace is maintained, it can be as easily taken from the front end over charging door) underground through a 5-in. cast-iron pipe, the end of the main being sealed in a seal pot. A water spray is introduced at a point as near to the furnace as possible, which effectively washes out the dust deposited in the 5-in. expansion pipe.

The connection should be made to the top of the foul main at a point between the exhauster governor and the retort house governor, so that sufficient vacuum can be obtained, and, preferably, at a point where any deposit is constantly washed away by the flow of tar continuously pumped through the " dry " hydraulic main. The control cock should be fixed directly into the foul main and with suitable operating gear for control from the retort house floor. It is better, also, in the interests of reliable working to have the plug of the plug cock spring loaded, as any dust that gets forward is of an abrasive nature and would rapidly seize the plug. The reason for fixing the control cock as near to the foul main as possible is to prevent tar getting back along the CO pipe when the cock is shut, resulting in the formation of pitch.

Some do not favour producer gas as a reducing agent on account of the possible deposition of naphthalene, and I might say that in this respect, in spite of using the gas and maintaining heats above the average due to the high efficiency of tar firing, the latest developments in which I am about to describe, no deposit of naphthalene occurred in any part of the district. I am of the opinion, however, that those undertakings having a declared calorific value of 450 B.Th.U. and lower might experience trouble with naphthalene formation were they to draw in producer gas, as for the lower calorific value gas the proportion of CO for dilution is, of course, higher. In cases like this, some form of total gasification plant would, I think, prove more suitable.

Tar Firing.

You will remember, some two years ago, hearing a paper read by my Chief, Mr. W. E. Young, at the Londonderry meeting of this Association, dealing with the subject of tar firing. At that time the method of burning tar successfully was in its infancy. The results, however, were such as to warrant further research. Briefly, the successful burning of tar depends on having, first, some means of guaranteeing a constant flow, and secondly, some method of forcibly injecting the tar into the combustion chamber in the form of a fine spray.

The three usual ways adopted by the fuel oil burning world consist, first, of a pressure system in which the liquid is forced from a jet and atomized by its velocity; secondly, the steam system, used to impart velocity to and propel the liquid into the furnace; and, finally, an air system in which air is used as a propelling medium. For use on a gas-works, I think we need not consider the first way, on account of the expensive pumps required and the means of driving them, so we will confine our attentions to the steam and air pressure burners.

In the case of a regenerative fired setting or a side producer bed, the tar may be injected direct into the combustion chamber, and, in the former, the producer arch need not be taken away as originally thought necessary. All that is required is a suitably sized hole in the front of the setting, and, on removal of the injector and replacing a brick or two, the bed can be continued on coke firing.

The primary and secondary air supplies should, of course, be sealed off for tar firing, as any air ascending from below would upset the flame formation. The method we adopted originally at Queenstown was to filter the tar carefully and regulate or fix a definite flow by means of a jet, taking the tar then to the injector, which was introduced through the producer charging door, the arch having been removed and the furnace filled with broken brick to a height level with the bottom of the charging door—a method which proved satisfactory, but had the disadvantage that when once converted to tar firing, the bed was useless for anything else but liquid fuel.

Filtration of Tar: Latest Improvements.

The latest improvements in connection with the filtration of the tar consist of the addition of a constant head tar supply tank in conjunction with a steam-cleaned filter, and the whole operation of cleaning the filter can be done in less than 20 seconds merely by the manipulation of several valves and without as much as touching a speck of tar. The necessity for a constant steam supply was, of course, a drawback, so we were led to experiment along other lines, which resulted in the development of an air blast form of injection in which an air pressure of some 28 in. water gauge was used.

This was provided by a five bladed fan about 14 in. in diameter, each blade having an area of approximately 10 sq. in., and running at between 3000 and 4000 revolutions per minute, the rotor mounted on ball bearings and effectively lubricated for continuous working.

The injector, in principle, is much the same as the steam model, except that larger passages for the low-pressure air are provided. With regard to the filter, with the object of doing away with steam, the usual type removable for cleaning was adopted, which proved entirely satisfactory. I am now experimenting with a similar type mechanically cleaned. Unfortunately, I am not in a position to give you the results as regards the value of tar compared with coke when using air blast, as the apparatus we had was dismantled and fixed in another works some few weeks after it was put into use at Queenstown. I can say, however, that the efficiency was much higher than that of the steam

model, which, when the price of coke was 31s. net per ton, made the value of tar 3·2d. per gallon.

In conclusion, I would say that tar firing for retort settings is a thing to be seriously considered, more especially by the management of a small works, since having an interchangeable coke and tar fired setting will enable him to meet effectively the sudden rush for coke which occurs at times.

Discussion.

Mr. G. WALMSLEY (Londonderry) remarked that they had listened to an interesting paper by the son of one of their old members, Mr. W. E. Young, of Queenstown. The paper was of a highly practical nature, but knowing the father this was just what they would have expected. He (Mr. Walmsley) thought that managers of small undertakings would do well to consider the addition of producer gas to coal gas with horizontal retorts. This would be far better than diluting the gas by other means. By introducing producer gas into the foul main or even into the hydraulic main, one would derive benefit from this lean gas picking up the various rich hydrocarbons that were in the foul main which, in a sense, were asking for the opportunity of being picked up, and in this way they would get an enriched gas at a cheap rate. It would be a good plan for a small works who were not in a position to make excess gas in their existing producer, to consider having a miniature producer alongside the retort bench, for providing the necessary producer gas. This should be a paying proposition.

PRODUCER GAS OR WATER GAS?

Mr. J. M'NICHOLL (Cork) pointed out that the Association were greatly indebted to the Young family. They had had more than one contribution from the author's father, and they had had his uncle in the chair. He presumed the test flame in Mr. Young's case was merely a flat-flame burner. If he were to use any more accurate testing apparatus, and go in for something more elaborate, the effect of the crude gas on the more delicate instruments might, he was afraid, be disastrous. The steps taken by the author to overcome the trouble due to time-lag were extremely interesting. In his opinion, all that could be said for producer gas was that it was better than drawing in products of combustion above the producer. Personally, he would not approve of diluting coal gas with either producer gas or furnace gases. The objection was the large amount of inert gases. If it was necessary to dilute straight coal gas, it was much better to add water gas, but he had to admit that in a small works this might be impossible. In such a case it was better to do as the author had done—take producer gas from the furnace, rather than draw in furnace gases from above the furnace. They had had a tar firing paper presented to them two years ago, and this further information would be of value to small works. The author had a very good market for his coke, so that it paid him to utilize his tar in this way, and thus increase his available coke; but for some people it would be better to diminish the coke and increase the tar available. The problem therefore varied in different cases.

The PRESIDENT remarked that it was a good sign that a young member should come forward in this way, and show that he possessed initiative and an inventive mind. The author had shown that tar firing could be a very lucrative outlet for a material which otherwise might land them in serious loss. In Waterford, owing to loss of consumption through circumstances over which they had no control, they found they had not sufficient coke to supply the demand, which was a good one, and at the same time they had a considerable amount of tar which was a burden to them. They therefore installed a tar-firing plant, with the result that they now had the extra coke they wanted and their tar to-day was worth 4¼d. per gallon in contractors' barrels, *ex* works. The effect of tar firing in his case had therefore been to largely reduce the cost of gas into holder.

Mr. YOUNG, replying, said he used a flat-flame burner for testing, and would not consider putting in elaborate instruments. For a small works his plan provided a good indication. With regard to the question of producer gas or water gas, the latter was, of course, much superior, but in the case of a small works it might not always be possible to choose.

History of the Bergin Process in Great Britain

In *The Times* Trade and Engineering Supplement for Aug. 12 last Mr. T. L. Gilmour explained how, just over twelve years ago, Dr. Bergius's process for obtaining oil from coal was brought to the notice of the British Government. Mr. Gilmour wrote as follows:—

As it happened, by what I suppose must be described as a pure accident, that I was the first to direct the attention of the Government to the claims made by Dr. Bergius and his supporters it may not be uninteresting to place on record in the broadest outline a brief account of the early stages of an enterprise which may not only revolutionize our industrial situation but may relieve us from our present dependence on overseas supplies for our fuel requirements for national defence purposes.

It was in the early days of 1921 that the late Mr. William Dederich described to me the Bergin process. He stated that many millions of gold marks had been spent by the firms of Goldschmidt, Friedlander Fuld, and Count Donnersmark in assisting Dr. Bergius to carry out his investigations and experiments, and that a factory had been erected under Dr. Bergius's direction at Rheinau between Heidelberg and Mannheim, where 30 tons of oil a day were being treated by the Bergin process and the liquefaction of coal had been proved on a less extensive scale.

From a contemporary record I make the following extract: "I discussed the matter at some length with Mr. Dederich and we agreed to the two following propositions:

"(*a*) That, assuming the claim made by Dr. Bergius to be well founded, the new process would ultimately revolutionize both the coal and the oil industries;

"(*b*) That a process which enabled coal to be converted into oil with the results indicated would be a factor of primary importance, both in peace and in war, to an Island State, and that accordingly the matter had a political side for Great Britain which could not be ignored."

With Mr. Dederich's full concurrence I decided to place the whole matter before the appropriate Government Department and got at once into communication with Sir John Cadman, the then head of the Petroleum Department. My first interview with Sir John Cadman took place about the middle of March. I asked if I should arrange to bring Dr. Bergius to London to see him, and he replied that before he saw Dr. Bergius he would like to have a sample of the oil submitted to him. To this I at once agreed, and a small bottle of oil was furnished in due course.

Official permission for Dr. Bergius to visit England was obtained through the Foreign Office, but owing to various delays it was not until June 10 that I was able to accompany Dr. Bergius to Sir John Cadman's office, where, in addition to Sir John Cadman and his principal assistant, we found Sir George Beilby, the Director of the Fuel Research Board of the Department of Scientific and Industrial Research, and Prof. Jocelyn Thorpe, Professor of Organic Chemistry at the Imperial College at South Kensington.

The interview lasted two hours. For the first hour and a half Dr. Bergius gave a brief historical sketch of the method by which he had developed his process and described fully the process itself and the technical means he had adopted to obtain the desired results. During the last half-hour Dr. Bergius answered fully and frankly all the questions which were put to him.

To regularize the financial position and to provide the further funds required, a company had been formed in Germany by the powerful groups already named in which the respective interests of the participants and of Dr. Bergius were defined. It was decided to retain the German rights under exclusive German control, but to seek outside Germany for further support in developing the process in the other countries of the world. When Mr. Dederich was first approached the Royal Dutch Oil group had already acquired, from the German company financing Dr. Bergius, an option to take over a 50% interest in the world rights of the Bergin process outside Germany, and had spent considerable sums in further development work. The original option to the Dutch group had been extended to Jan. 31, 1922.

It was in these circumstances that Mr. Dederich had obtained from the German group a provisional option to acquire the rights both for coal and oil for the whole of the British Empire and for certain other countries, including Persia and Egypt. This provisional option was subject to the subsequent approval of the Dutch group, should it exercise its option to acquire a half-interest in the world rights outside Germany, but the representatives of the German company were confident that the approval of the Dutch group would not be withheld.

After Dr. Bergius's interview with Sir John Cadman and the other representatives of the British Government steps were taken to bring the business to the notice of Sir Charles Greenway (now Lord Greenway), the then Chairman of the Anglo-Persian Oil Company.

The next move was that in August the Royal Dutch group intimated that it was prepared to exercise its option without waiting for the expiry of the option period. A meeting was accordingly arranged early in September between the German and the Dutch groups to settle the

final terms of the agreement under which the world rights, exclusive of Germany, were vested in a Dutch company, the Bergin International Company, the capital being equally divided between the German and Dutch groups. An intimation was conveyed to Mr. Dederich by the German group that it would be desirable that representatives of British interests should be available in Holland, as it was proposed, as part of the arrangements to be discussed, to invite the Dutch group to agree to the provisional option being given over the British and other rights.

It was found possible for Dr. A. E. Dunstan, the Chief Chemist of the Anglo-Persian Oil Company, to accompany Mr. Dederich and myself to The Hague, where we arrived on the evening of Sept. 7.

The negotiations followed the anticipated course, both groups confirming the provisional option granted to Mr. Dederich. While the negotiations were in progress Dr. Dunstan availed himself of the opportunity to discuss various technical matters with Dr. Bergius—whom he met for the first time—and with Dr. Bergius's technical assistants. From The Hague the party went on to Heidelberg, and Dr. Dunstan was given every facility to make a thorough examination of the factory at Rheinau. As we left he said to me: "This is not an invention, it is a revolution," and in the subsequent negotiations with the Anglo-Persian Company, Dr. Dunstan remained a firm advocate of the acquisition by the Anglo-Persian Company of the British rights in the Bergin process.

It would serve no useful purpose to give even in outline an account of the negotiations with the Anglo-German Company which extended over the next twelve months, or to explain how it was that, after the heads of a proposed agreement had been initialled, the negotiations finally fell through.

The failure to reach an agreement was in no way due to any doubts as to the ultimate value of the process, though it was recognized that much work still remained to be done before hydrogenation could be accepted as a commercially practicable proposal on a large scale. The magnitude of the task from a financial point of view and the necessity of commanding technical advice of the highest order rigidly restricted the area from which assistance could be sought. Lord Milner, who fully recognized the national importance of the issues involved, interested himself to the extent of giving personal introductions, and Lord Haldane, no less alive to the same aspect of the problem, asked to be kept informed of any developments which took place.

After strenuous endeavours extending over a further year, Mr. Dederich and his associates saw little chance of being able to carry the matter to a successful issue, and Dr. Bergius turned in another direction. He had for some considerable time been devoting much attention to the problem of the extraction of sugar from wood, an enterprise in which he was brought into association with the well-known chemist Dr. W. R. Ormandy. Putting on one side the idea of obtaining from any single firm the necessary financial and technical support for developing the Bergin process, Dr. Ormandy decided to try the method of combination. At Dr. Bergius's request the writer continued for some years to act as his personal representative in this country.

The rest of the story may be briefly told. Dr. Ormandy succeeded in organizing under the title "The British Bergius Syndicate" a very powerful group of about a dozen individuals and companies, the combined capital of which was well over £100,000,000 sterling. These companies, representing some of the largest gas, steel, coal, coke, and chemical industries in the country, subscribing in varying proportions a capital of £23,000 to enable further tests, particularly with English coals, to be carried out here and in Germany. An arrangement was also made by which the British Government undertook the responsibility for certain experimental work at the Greenwich Station of the Fuel Research Board. Subsequently Sir Alfred Mond intimated a desire to be associated in the work, and it was arranged that Messrs. Brunner Mond & Co. should subscribe a further £10,000 to the capital of the syndicate, which gave them much the largest individual interest. At a later stage it was arranged that Imperial Chemical Industries, Ltd., should buy out the other participants of the syndicate, and the world rights in the Bergin process are now held by International Hydrogenation Patents, Ltd., formed in 1930 at The Hague, in which Imperial Chemical Industries, Ltd., the Shell Mex Company, the Standard Oil Company, and I. G. Farben Industrie are participants.

The above account is the barest outline of one aspect of an extraordinarily complicated series of transactions; but in view of the immense possibilities inherent in the process associated with Dr. Bergius's name it may not be uninteresting to place that bare outline on record while the documents on which it is based are available.

CONTINENTAL NOTES

STATISTICS RELATIVE TO TAR IN FRANCE.

The Annual Report of the Central Committee of French Tar Producers and Distillers for 1932 is reproduced in the *Journal des Usines à Gaz*, 1933, **57**, 404-408 (Aug. 5).

The quantities of tar produced in 1931 and 1932 were as follows, in tonnes:

—	1931.		1932.	
	France.	Sarre.	France.	Sarre.
Gas-works	237,687	1,300	226,787	1,000
Coke oven works, &c.	322,357	121,670	268,162	94,780
	560,044	122,970	494,949	95,780

The quantities continue to decline, as will be evident if these figures are compared with those for 1929 and 1930 given in the "JOURNAL," 1931, **196**, 135.

Particulars of imports and exports of tar are as follows:

	1931.		1932.
Total imports	130,567	..	221,118
Imports from Great Britain	80,612	..	101,742
Total exports	29,125	..	11,302

The organizations represented by the Central Committee imported 142,522 tonnes of crude tar and 2900 tonnes of prepared tar in 1932.

The consumption of tar was as follows, the figures for France and the Sarre being combined:

	1931.		1932.
Total quantity available — *i.e.*, production + imports + reduction in stocks − exports	796,456	..	801,498
Distilled to pitch	310,681	..	262,800
Used on roads	470,137*	..	521,217*
Used for steel works tar, &c.	15,638	..	17,481
	796,456	..	801,498

* Of which 1000 tonnes were used in the Sarre.

The consumption of tar for road purposes continues to increase rapidly. Much of the tar is, however, used in crude form on the roads, since, in 1932, only 339,846 tonnes of tar were converted into road tar. The use of prepared tar is, however, becoming more general and the quantity of crude tar used decreases each year, though the quantity of road tar increases, as does also the total quantity used on the roads.

Imports of pitch in 1932 reached the record figure of 476,338 tonnes, of which 189,852 tonnes came from Great Britain, the next largest source of supply being the United States, which contributed 111,799 tonnes.

The report refers to the fact that the largest outlet for tar is for road purposes, and the Committee counsels its constituent members to take up the manufacture of road tar either themselves or co-operatively.

Criticisms have been made that tar dries slowly, and several methods have been introduced for obviating this. On the one hand, hot application has enabled use to be made of highly viscous tars, and these set rapidly. Other successful methods are the use of bitumen blends (25,000 tonnes in 1932) containing 80% of tar, and the recent introduction of "filled" tars containing coal or limestone.

Gasholders and Social Amenities

In the *Yorkshire Post* for Aug. 14 the following editorial appeared on the subject of gasholders:

"The societies which seek to protect the picturesqueness of our countryside and especially of our ancient towns have achieved some successes, but they have found repeated 'Waterloos' at the hands of the gas companies. The Oxford Preservation Trust has been in conflict with the Gas Company which serves that ancient and beautiful city with respect to the Company's gasometers which, if they are true to kind, are necessarily of appalling ugliness. The best 'compromise' which the parties concerned have been able to reach has been an agreement to paint the gasometers a 'colour which will tend to hide them'—their master-decorator must surely be an expert magician with supplies of invisible paint at his disposal—and to plant a ring of poplar trees around them as a screen. Unless the Oxford gasometers are very much better designed—that is to say, more adequately sunk in the ground—than usual the remedy sounds like adding insult to injury. Those who for the first time in recent years have approached the city of York from the east and have suffered the shock of a first view of the city's giant gasometer, the enormous bulk of which puts everything out of scale, must have been amused at the idea of a circle of poplars—even Lombardy poplars—planted to hide such an erection. A row of Sequoias, or Wellingtonias, of the Californian magnitude, given adequate time, might do something to achieve the camouflage, but long before that stage would be reached it is probable that gas-lighting and gasometers will be a thing of the distant past. And there can be little doubt that the engineers will have been compelled—for safety as well as for the amenities of the town they serve—to 'dig themselves in.' An excavation of the ground no larger than is as a matter of course provided for the basements of a good general store would add to capital cost of a gas company only a relatively small sum comparable to the value of the privileges they claim, and it would be easy to hide the gasometer completely or make it no more objectionably conspicuous than a row of houses. The widespread devastation which might ensue from a gasholder very much smaller than those gigantic constructions above ground commonly placed amidst the crowded homes of the people of an English town was shown by the terrible explosion which wrecked the town of Neunkirchen, on the Saar coalfield, last February. We have had few comparable disasters of the kind in the century of gas-lighting in England, but that is no doubt because our engineers are careful—and lucky."

To this attack on the Gas Industry Mr. John J. Baines, a Director of Messrs. Clayton, Son, & Co., Ltd., of Hunslet, replied in a letter published in the *Yorkshire Post* for the 16th inst.:

"We were surprised," he wrote, "on reading through your Monday's issue to find an editorial couched in such objectionable terms in respect to gasholders, and against the Gas Industry generally. If the views expressed therein had appeared in the form of a letter to the Editor in your Correspondence columns, we should have considered it a violent outburst by some prejudiced 'Anti-gas,' but to appear in your columns as the balanced views of your Editorial Department, we take it to be a radical departure from the best traditions of the *Yorkshire Post* editorials.

"Opinions in regard to the appearance of gasholders generally are to a great extent a matter of taste, and we cannot admit that the waterless type of gasholder, as instanced at York, is by any means ugly. Gasholders of this style are of a plain monumental type, which, in our opinion, possess a certain dignity of design, following the solid style of architecture which is now being adopted generally, as against the more ornamental type which it has superseded. As to whether the York gasholder is placed in the best situation considering its classic surroundings is another question.

"We would point out that many objections have been raised to the electric pylons which now stalk through the countryside like steel-limbed robots, but they, like gasholders, serve a useful purpose to the community, besides which appearances, although important, are secondary.

"We agree that the shape, colour, and appearance of gasholders provide fair ground for criticism, and if your article had ended there, we should have taken no serious objection, but when in addition you go out of your way to predict the end of gas lighting, and that gasholders also will be a thing of the past, we consider you are going too far and not holding the balance fairly.

"The official pronouncement as to the cause of the unfortunate Neunkirchen explosion has yet to be made, but we have been building gasholders for over 70 years for Great Britain and all parts of the world, along with other firms in the same Industry, and can say that accidents arising from the use of gasholders are very few and far between, and constitute as small a percentage as any other apparatus used largely for providing industrial power.

"The Gas Industry is making progress in Great Britain to-day, in spite of the State-favoured competition, and in America—one of the centres of electrical power—it continues to make rapid strides, extensions going on there in a greater degree than in this country. Gas is still serving its day and generation well in countless homes, and providing power and heat in increasing quantities for thousands of industrial concerns throughout the country, and remains probably also the best customer to our stricken coal industry.

"We trust to continue bringing business to South Leeds in the gasholder line, and so provide employment for our workpeople, both inside and out, and just wonder why you should have gone out of your way to refer detrimentally to an Industry which is of such paramount importance to the nation's industrial requirements and household needs, and to state that gas engineers, while having been careful, have also been lucky."

In the same issue of the *Yorkshire Post* the following apologetic editorial appeared:

"There is a philosophical proverb which asserts that there is no disputing about taste. We are reminded of this piece of ancient tolerance by the letter of the Director of a well-known firm of Leeds engineers which appears in our correspondence columns to-day protesting against the animadversions on the Oxford gasometer, and incidentally that of York, in one of our leading articles on Monday. Although, no doubt, there is much disputation on matters of taste which is futile, there is surely much that is valuable, and the societies organized to guard the amenities of our countryside and our historic towns, though inevitably contentious, are in their results most valuable. The beauty of towns like Oxford and York is assuredly everybody's business to defend, and it is not to be interpreted as depreciation of the public services or of the engineers if the latter are encouraged to show as much modesty as may be when their works come into comparison either with Nature or with the works of an age which knew how to reconcile utility with beauty. This is an admonition which we have more than once addressed to the designers of the electrical pylons.

"In one matter our correspondent vitally misunderstands our leading article, in its references to the future of the Gas Industry. The Oxford critics of the local gasometer, or 'gasholder' as our correspondents of yesterday and to-day would call it, have arranged for a screen of poplars to cover it from public gaze. Instead of the poplar, a short-lived tree, we suggested the use of the great Sequoias, sometimes called Wellingtonias, which are credited with a normal life of one to three thousand years, and have a bulk and height more in scale with the giant products of modern engineering. Many museums have sections of these majestic trees, with the annual 'rings' of growth marked—if the calculation is reasonably correct—indicating the size of the tree at the Norman Conquest, the discovery of America, and other such historical dates. Such a comparison is complimentary to the permanence of the Gas Industry, rather than depreciatory, as our correspondent seems to think. Actually the Royal Commission on our coal supplies over which the late Lord Allerton presided found reason to believe that the English coalfields will not be exhausted in less than six hundred years. When the coal supplies are at an end there will be an end to the Gas Industry, and a screen of Sequoias will not yet have reached senility. But such a margin of usefulness as six hundred years is surely enough for the most aspiring gas enthusiast."

"Sands, Clays, and Minerals."

A Simple Method of Testing Coal.

With the July, 1933, issue of "Sands, Clays, and Minerals," published quarterly by Algernon Lewin Curtis, of Chatteris, this interesting technical magazine completes its first volume, and a comprehensive index of the first four issues is included. A glance through this index serves as an indication of the very wide variety of topics dealt with in this publication.

The present issue (No. 4) contains instructive information by competent authorities on Peat, Coal Testing, Fluorspar, Platinum-Iridium Scrap, Analysis of Sand, an illuminating section on Canada's Mineral Wealth, together with notes on a variety of other subjects.

G. W. Himus contributes the section on "A Simple Method of Coal Testing," and deals with determination of moisture, volatile matter, and ash, and the reporting and interpretation of the proximate analysis. The commercial classification of coal, states the writer, is based on its suitability or otherwise for certain specific purposes, such as steam-raising, gas-making, furnace firing, the manufacture of metallurgical coke, &c., and the probable fields of utility of a particular coal are largely dependent on the amount of "volatile matter" expelled when it is heated out of contact with air and on the character of the solid residue.

By studying the behaviour of a coal when carbonized out of contact with air under standardized conditions, it is possible to predict with some certainty its likely uses, and if, in addition, the moisture and ash are also determined, the comparative value may also be approximately assessed.

The determinations ordinarily made are (*a*) moisture, (*b*) volatile matter, and (*c*) ash, constituting the so-called "proximate analysis," which is really an assay rather than an analysis.

Gas Companies' Results in 1932

Bridport.

During the year an issue of £4000 5% debentures was made for the purpose of eliminating the bank overdraft. This issue to shareholders met with a most gratifying response. A further sum of £500 has been placed to general reserve fund and dividends at the rate of 5% on the "A" preference, 6¼% on the "B" cumulative preference, and 7½% on the ordinary shares, less tax, were recommended, carrying forward a balance of £1328. At the annual meeting, the Chairman, Mr. W. G. Ralls, said that the number of cookers in Bridport was approximately 1400, more than one cooker to every two consumers of gas, to say nothing of boiling burners in the small houses for the early cup of tea. The advantages of gas for hot water installations were also being increasingly recognized, and they had carried out some important work in this connection.

Camborne.

The Directors of the Camborne Gas Company, in submitting their report for the year ended June 30, 1933, state that the demand for gas during the past year has been fully maintained, and while there has been a slight reduction in the consumption of gas for industrial purposes, this has been made up by an increased demand for private and domestic use. The balance standing to the credit of profit and loss account, amounting to £4356, the Directors recommend should be appropriated as follows: In paying a dividend at the rate of 5% per annum (less income-tax), and in carrying forward to the next account £3643.

Morpeth.

The gross profit of the Morpeth Gas Light Company for the year amounts to £3200, which, with £1304 brought forward from last year, gives a total of £4504 available. The Directors recommend that this be dealt with as follows: In writing off for depreciation on meters and cookers, £576; in placing to reserve for special renewals of plant, &c., £250; in placing to general reserve account, £100; income-tax, £634; in paying 6% for the year on preference shares, less income-tax (of this, an interim dividend amounting to £315, being at the rate of 3%, less tax, was paid in February last); in paying 7%, free of tax, for the year on ordinary shares (of this, an interim dividend amounting to £423, being at the rate of 2½%, free of tax, was paid in February last), and in carrying forward a balance of undivided profits of £1126. The business of the Company shows satisfactory progress, the make of gas having increased by 1,225,000 c.ft.; the amount received from sales of gas is larger by £302 than in the previous year; the profits are also higher by £200—viz., £3200, against £3000 last year. The year is memorable as being the Centenary of the Company formed by a trust deed on April 24, 1833. In connection with this very notable event, the "History of the Morpeth Gas Company," written and compiled by the Chairman, has been issued to each shareholder and to others interested in the Company. The brochure, which was referred to in the "JOURNAL" for July 19, p. 141, records the salient points in the history of the Company, with some interesting side-lights on Morpeth as it was 100 years ago. Morpeth was first lighted by gas on Nov. 19, 1833, and it is proposed to give an exhibition of floodlighting in Morpeth on the nearest available date to this anniversary. It is also proposed to entertain the shareholders to a conversazione, with light refreshments, in the Town Hall on the occasion.

Shrewsbury.

The gross profit of the Shrewsbury Gas Light Company for the year ended June 30, 1933, amounts to £9912. After allowing for the interim dividend of 2½% (less tax) paid in March last, and the interest on mortgages for the year, the balance of net profit available amounts to £12,395. The Directors recommend that a final dividend of 4½% (less tax), making 6¾% (less tax) for the year, be now declared, payable on and after Sept. 2, 1933. The reserve fund now stands at £13,480. There has been a decrease of 3% in the sales of gas during the past year, but a main has been laid to serve Bayston Hill and district, and already a large number of consumers have been secured. The number of cookers on hire at June 30 was 5189, together with 2245 fires and radiators. There were also 3304 ordinary and 6543 prepayment meters in use. In addition, the total sales of gas cookers, fires, water heaters, &c., during the year amounted to 845.

Wellingborough.

The Directors of the Wellingborough Gas Light Company present a report for the year ended June 30, 1933, which states that an interim half-year's dividend of £4206 was paid on March 1. After providing for interest there remains an available balance of £9720. The Directors recommend that dividends at the same rate as before (7½% on the "original" and 6% on the "additional" shares, less income-tax) be declared for the half-year, and paid to the shareholders on Sept. 1. The payment of dividends and tax thereon will absorb the sum of £4206, leaving a balance of £5513 to be carried forward. The vertical retorts were brought into use towards the end of 1932; hence the accounts do not reflect the saving to be expected from a full year's operation. The results already obtained confirm the favourable opinion formed by the Directors, and fulfil their highest anticipation.

Corporation Undertakings' Results

Kirkcaldy.

The Annual Report for the year ended May 15, 1933, submitted by the Gas Committee to the Town Council of Kirkcaldy shows an expenditure on revenue account amounting to £28,324 and an income of £44,919, giving a gross profit of £16,595. To this is added a sum of £8 for interest on consumers' deposits, bringing the income at net revenue to £16,603. A credit balance of £1646 is shown after deducting a sum of £14,956, which includes payment of interest on loans, contribution to sinking fund, income-tax and borrowing charges, and £500 to depreciation and renewals fund. The quantity of coal carbonized was 10,908 tons at an average price of 18s. 9·37d., and represents an increase over the preceding year of 349 tons. The quantity of gas made per ton of coal carbonized was 19,055 c.ft., as compared with 19,047 c.ft. for the previous year. The gas sold and accounted-for amounted to 199,031,500 c.ft., while the total gas produced was 207,862,000 c.ft.—an increase over the previous year of 6,739,000 c.ft., or 3·35%. Coke and breeze sold per ton of coal carbonized was 6·43 cwt., and 22s. 4·32d. per ton was the average price obtained for coke. Tar made per ton of coal carbonized was 20·45 gallons, and the average price obtained was 2·48d. per gallon. The total number of consumers was 10,994, as compared with 10,848 in 1931-32, and, of these, 4937 used ordinary meters and 5978 had prepayment meters, the other consumers being engine and trade.

Salford.

While the number of consumers continues to increase, there has been a decrease in the sales of gas amounting to 2·95%. The coal carbonized during the year amounted to 118,264 tons, as compared with 123,082 tons for the previous year. The quantity of gas made was 1,806,450,000 c.ft., as compared with 1,848,936,000 c.ft. for the previous year. The length of gas mains has increased during the year from 363 miles 903 yards to 369 miles 1388 yards. The total number of ordinary and prepayment gas cookers on hire at March 31, 1933, was 30,671, and the total number of gas fires on hire at the same date was 9257. There is an increase in the receipts from the sale of residual products of £3549. This increase is entirely due to increased market prices for tar.

Oswaldtwistle.

The Annual Report of Oswaldtwistle Council Gas Department shows a net profit of £1422, an increase of £354. Of this, £1000 was allocated for the relief of the rates, and £378 transferred to reserve fund, which now amounts to £3978. The report is the second prepared by Mr. D. J. Colvin, the present Manager. Despite trade depression the decreased output represented only 2% on a total output of 113,665,000 c.ft. The amount supplied by prepayment meters showed an increase of 648,600 c.ft., gas supplied through ordinary meters decreasing 3,389,000 c.ft.; and for industrial purposes by 838,300 c.ft. Prepayment meters in use increased by 40. Of the 3818 meters in use, 2037 are prepayment, against 1781 ordinary meters. One encouraging feature "has been the very satisfactory reduction in leakage, due largely to replacement of defective and obsolete meters, and the systematic overhauling of mains and services." Unaccounted-for gas decreased by 2,712,100 c.ft., the lowest recorded figure for 18 years. A greatly improved quality of coke had been put on the market, the result being that the whole of the stock was disposed of. Prices suffered a reduction consequent on large stocks held throughout the country. Distribution work cost £2484, or 5·56d. per 1000 c.ft. of gas sold. A loan for a combined naphthalene extraction and benzole recovery plant had been sanctioned by the Ministry of Health.

GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

The volume of business continued to be very heavy last week, in fact the best which the Stock Exchange has experienced in August for some time. Home Rails were firm favourites, and in the absence of sellers' quotations, particularly those for prior-charge stocks, rose substantially. Many leading industrials and South African gold shares also had a large following. The demand for gilt-edged securities eased up somewhat, though not enough to affect values. The week closed with the expectation of another bright week.

Gas stocks and shares were no exception to the general trend of events, and any stock coming into the market was speedily absorbed. A number of ordinary and preference stocks became *ex* div. on Aug. 14, and apart from these there were only two changes in value of note—viz., Commercial ordinary which advanced a further 2 points to 116½, and a gain of 3 points in Imperial Continental ordinary to 220.

At the time of writing there is little ordinary stock available, but among preference issues a parcel of 1000 South-Eastern Gas Corporation 4½% cumulative preference shares is on offer at 22s. to give a gross flat yield of £4 2s. These shares are redeemable in 1980 at par or after 1970 at 20s. 6d. There is also £5000 of the new Wandsworth 5% preference stock on offer at 116½, free of stamp duty, yielding £4 6s.; four months' dividend on this stock is payable in March next.

There are several small lots of perpetual debenture stocks available, among which are the following:

Amount Offered.	—	Price.	Yield.
£			£ s. d.
100	Leatherhead 4%	101½	3 19 0
140	Mid-Southern Utility 4%	102	3 18 0
400	North Middlesex 5%	120	4 3 3
215	Oxford 4%	104	3 17 0
200	Southgate 5 „	120	4 3 3
125	Uxbridge 4%	100	4 0 0

The interest in each case is payable in January and July.

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *Aug.* 21.

The market for tar products continues steady; current prices are as under:

Pitch, 80s. per ton f.o.b.

Creosote, 3d. per gallon.

Refined tar, 4d. to 4¼d. per gallon in bulk at makers' works.

Pure toluole is firm at 2s. 7d. to 2s. 8d.; pure benzole, 1s. 9d.; solvent naphtha, 95/160, is firm at 1s. 7d. to 1s. 8d.; and 90/140 pyridine bases, 4s. 3d. to 4s. 6d.—all per gallon naked at makers' works.

Tar Products in the Provinces.

Aug. 21.

The average prices of gas-works products during the week were: Gas-works tar, 31s. to 36s. Pitch—East Coast, 75s. to 77s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 75s. to 77s. 6d.* Toluole, naked, North, 1s. 9d. to 1s. 10d. Coal-tar crude naphtha, in bulk, North, 6d. to 6¼d. Solvent naphtha, naked, North, 1s. 5½d. to 1s. 6d. Heavy naphtha, North, 10d. to 11d. Creosote, *ex* works, in bulk, North, liquid and salty, 2d. to 2¼d.; low gravity, 2d.; Scotland, 2d. to 2¼d. Heavy oils, in bulk, North, 4d. to 4¼d. Carbolic acid, 60's, 2s. 7½d. to 2s. 9d. Naphthalene, £9 to £10. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Aug.* 19.

New business is limited, but prices are well maintained and stocks are gradually being reduced.

Crude gas-works tar.—The actual value remains at 42s. 6d. to 47s. 6d. per ton *ex* works.

Pitch.—Export value is nominal at 75s. per ton f.o.b. Glasgow. In the home market 75s. per ton *ex* works continues to be quoted.

Refined tar to Ministry of Transport Specification is gradually easing, and to-day's price is about 3¼d. per gallon *ex* works in buyers' packages.

Creosote oil.—While there is not much activity, prices are being maintained. B.E.S.A. Specification is 2¾d. to 3d. per gallon; low gravity, 2¾d. to 3d. per gallon; and neutral oil, 2¾d. to 3d. per gallon—all in bulk *ex* works.

Cresylic acid is quietly steady. Pale, 97/99%, is 10½d. to 11½d. per gallon; dark, 97/99%, 9d. to 10d. per gallon; and pale, 99/100%, 1s. 2d. to 1s. 3d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha.—Available supplies command 4d. to 4½d. per gallon *ex* works in bulk, according to quantity and quality.

Solvent naphtha.—90/160 grade is scarce and price is firm at 1s. 4d. per gallon. 90/190 heavy naphtha continues to be offered at 1s. per gallon.

Motor benzole.—Production is low, and 1s. 5d. per gallon *ex* works is being obtained.

Pyridines.—90/160 grade is 3s. to 3s. 8d. per gallon, and 90/140 grade 3s. 8d. to 3s. 6d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s. d.		s. d.	
Crude benzole	0 9	to	0 9½	per gallon at works
Motor „	1 4	„	1 4½	„ „ „
Pure „	1 7½	„	1 8	„ „ „

Contracts Advertised To-Day.

Boosters.

Blackpool Gas Department. [p. 416.]

Main Laying, &c.

Blackpool Gas Department. [p. 416.]

Pipes and Specials.

Blackpool Gas Department. [p. 416.]

Register of Patents

Stoves for Frying, Water Heating, and Other Purposes.—No. 389,182.

SOUTH METROPOLITAN GAS COMPANY and CHANDLER, D., both of 709, Old Kent Road, S.E. 15.

No. 31,750; Nov. 16, 1931.

This invention relates to apparatus which is heated by gaseous or liquid fuel, and is suitable for frying fish, heating water, and other purposes. The main objects are to obtain an even distribution of heat and to simplify the construction of such apparatus. The invention consists in the combination of a heating chamber, an outlet flue leading from the chamber, and a frying pan, water heater, or other article to be heated, adapted to co-operate with the heating chamber to form a closed space; the bottom of the said article being provided with ribs which are integral therewith and form, together with the bottom of the article and the heating chamber, passages which direct the products of combustion towards the outlet flue. Preferably the burners are mounted in a unit which is located at that end of the heating chamber which is opposite to the outlet flue and is so attached to the chamber as to be readily removable.

Gas Burners.—No. 389,602.

STANWORTH, S., and STANWORTH, J., both of Burnley.

No. 665; Jan. 9, 1932.

This invention relates to gas burners for use in connection with domestic wash boilers or other water heating appliances, and has for its object to introduce an improved construction which will prevent water of condensation on the boiler surface from dripping on to the floor, and may also increase the air induction and so obtain better combustion and a better flame. The burner is provided with one or more drip trays; and in order to obtain an increased air inductive effect by the action of the gas passing through the jet to the burner, the jet may be formed with a conical aperture that terminates in a sharp edge, with the result that as the gas leaves such aperture, it gradually opens out and fills the whole of the bore within the burner tube. Thus the maximum amount of air is introduced through the air inlet in the burner tube.

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf-Yr. % p.a.	Dividends. Last Hf-Yr. % p.a.	NAME.	Quotations. Aug. 18.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week
1,551,868	Stk.	Apl. 3	7⅞	7	Alliance & Dublin Ord. ...	120–130	...	...
374,000	,,	July 10	4	4	Do. 4 p.c. Deb. ...	85–95	...	...
557,655	,,	Mar. 6	7	7	Barnet Ord. 7 p.c.	157–162	...	...
300,000	1	May 8	1/4⅜	1/9⅜	Bombay, Ltd.	25/–27/–	...	...
178,280	Stk.	Aug. 14	9½	9½	Bournemouth sliding scale	192–202*	–3	...
550,050	,,	,,	7	7	Do. 7 p.c. max. ...	154–159*	–3	...
439,160	,,	,,	6	6	Do. 6 p.c. Pref. ...	135–140*	–2	...
50,000	,,	June 26	3	3	Do. 3 p.c. Deb. ...	74–79	...	...
162,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	99–104	...	...
210,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	120–125	...	...
357,900	,,	Mar. 6	7½	7½	Brighton, &c. 6 p.c. Con. ...	153–158	...	155–157
540,000	,,	,,	6⅔	6⅔	Do. 5 p.c. Con. ...	143–148	...	...
195,500	,,	,,	6	6	Do. 6 p.c. B Pref.	133–138	...	...
1,487,500	,,	July 24	5	5	Bristol 5 p.c. max.	109½–110½*a*	...	...
120,420	,,	June 26	4	4	Do. 1st 4 p.c. Deb. ...	99–100*a*	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	99–100*a*	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	119–122*a*	...	...
855,000	,,	Apl. 3	7	8	British Ord.	147–162	...	148–150
100,000	,,	June 26	7	7	Do. 7 p.c. Pref.	145–150	...	...
350,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	108–113	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	94–99	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	103–113	...	...
160,000	,,	June 26	5	5	Cambridge 5 p.c. Deb. ...	115–120	...	...
100,000	10	May 22	6	4	Cape Town, Ltd.	7–8	...	...
100,000	10	Apl. 24	4½	4½	Do. 4½ p.c. Pref. ...	7–8	+1	...
150,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. ...	92–97	...	...
626,860	,,	July 24	6	6	Cardiff Con. Ord.	117–122	...	...
237,860	,,	June 26	5	5	Do. 5 p.c. Red. Deb.	105–110	...	...
157,150	,,	Aug. 14	6½	5	Chester 5 p.c. Ord.	105–110½*	–2	...
98,936	1	May 22	2/–	2/–	Colombo, Ltd. Ord.... ...	25/–30/–	...	...
24,500	1	,,	1/4½	1/4½	Do. 7 p.c. Pref. ..	18/6–20/6	...	...
609,204	1	Mar. 20	/11'48	/11'48	Colonial Gas Assn. Ltd. Ord.	17/6–20/–	...	...
296,053	1	,,	1/3'30	1/3'30	Do. 8 p.c. Pref.	1 7/8–1 9/8	...	...
1,796,955	Stk.	July 24	6½	5	Commercial Ord.	114–119	+2	115–117
475,000	,,	June 12	3	3	Do. 3 p.c. Deb. ...	73–78	...	...
265,272	,,	Mar. 6	—	5	Do. 5 p.c. Deb. ...	120–125	...	...
807,560	,,	Aug. 14	7	7	Croydon sliding scale ...	143–145*	–2	145–147
469,590	,,	,,	5	5	Do. max. div.	99–104*	–2	102½–104½
500,000	,,	July 10	5	5	Do. 5 p.c. Deb.	118–123	...	125–125½
542,270	,,	Mar. 6	7	10	Derby Con.	155–165*e*	...	...
55,000	,,	July 10	4	4	Do. 4 p.c. Deb.	93–98*c*	...	...
209,000	,,	Mar. 6	5	5	East Hull Ord. 5 p.c. ...	106–111	...	...
179,500	,,	Mar. 6	6	6	East Surrey Ord. 5 p.c. ...	122–127	...	...
155,019	,,	June 26	5	5	Do. 5 p.c. Deb. ...	117–124	...	120
1,002,180	,,	Apl. 3	†5	†7	European, Ltd.	132–137	...	136
19,373,992	,,	Aug. 14	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	25/3–26/3*f* *	–/6	25/6–26/1½
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max. ...	83–86*	–1	84–85
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	100–103*	–1	100½–102½
6,102,497	,,	June 12	3	3	Do. 3 p.c. Con. Deb. ...	76–79	...	77½–79
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	114–117	+1	115–116½
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	111–114	...	112–114
270,466	,,	Mar. 6	6	6	Harrogate New Cons. ...	115–120	...	...
82,500	,,	Mar. 6	7	7	Hastings & St. L. 5 p.c. Conv	138–143	...	...
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv	110–115	...	113–114
70,000	10	Apl. 24	†10	†10	Hongkong & China, Ltd. ...	—	...	...
218,200	Stk.	Aug. 14	6	6	Hornsey Con. 3½ p.c. ...	120–125*	–2	...
5,600,000	,,	May 22	10	14	Imperial Continental Cap.	215–225	+3	217–220
223,130	,,	Aug. 14	3½	3½	Do. 3½ p.c. Red. Deb.	86–93*	–1	...
235,242	,,	Aug. 14	8½	8½	Lea Bridge 5 p.c. Ord. ...	167–172*	–3	...
2,145,907	,,	Aug. 14	6	6	Liverpool 5 p.c. Ord. ...	123½–124½*	–½	...
245,500	,,	June 26	5	5	Do. 5 p.c. Red. Pref. ...	103–113*	...	...
306,083	,,	July 17	4	4	Do. 4 p.c. Deb. ...	99½–101½	...	...
165,736	,,	Feb. 20	8	10	Maidstone 5 p.c. Cap. ...	180–200	...	...
56,176	,,	July 10	3	3	Do. 3 p.c. Deb. ...	69–74*	...	...
75,000	6	June 12	†10	†10	Malta & Mediterranean ...	9 11	...	...
392,000	—	Apl. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	98–103	...	...
231,978	Stk.	Mar. 6	5	5	M. S. Utility "C." Cons. ...	103–108	...	...
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	93–98	...	...
112,126	,,	June 26	4	4	Do. 4 p.c. Deb. ...	100–102	...	...
148,955	,,	,,	5	5	Do. 5 p.c. Deb. ...	113–118	...	...
675,000	,,	21 May '31	†6	†6	Montevideo, Ltd.	55–65	...	...
2,061,315	,,	Aug. 14	5½	5	Newcastle & Gateshead Con.	24/3–25/–*d* *	–/1½	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	97–99*d* *	–½	...
776,706	,,	July 10	3½	3½	Do. 3½ p.c. Deb. ...	91–93*d*	...	...
277,285	,,	May 8	5	5	Do. 5 p.c. Deb. '43...	107–109*d*	...	...
274,000	,,	Aug. 14	5	5	Newport (Mon.) 5 p.c. max.	100–102*a* *	–2	...
204,940	,,	Mar. 20	7½	7½	North Middlesex 6 p.c. Cor.	147–152	...	...
396,160	,,	Aug. 14	5	5	Northampton 5 p.c. max. ...	101–106*	–2	...
300,000	,,	Apl. 24	9	7	Oriental, Ltd.	114–119	...	...
316,617	,,	June 26	8	8	Plym'th & Stonehouse 5 p.c.	158–163	...	160
504,416	,,	Feb. 20	8	8	Portsm'th Con. Stk. 4 p.c. Std.	161–166	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	104–109	...	...
114,000	,,	Aug. 14	5	5	Preston 5 p.c. Pref.	101–106*	–2	...
686,312	,,	July 24	4	4	Primitiva 4 p.c. Rd. Db. 1911	86–91	...	86–87½
389,813	,,	June 26	4	4	Do. 4 p.c. Cons. Deb.	82–87	...	...
150,000	10	Mar. 20	6	6	San Paulo 6 p.c. Pref. ...	6⅞–7⅛	...	...
1,736,968	Stk.	Sept. 5	6	6	Sheffield Cons.	127–130*e*	...	...
95,000	,,	July 10	4	4	Do. 4 p.c. Deb.	90–94*e*	...	...
133,201	,,	Feb. 20	8½	5	Shrewsbury 5 p.c. Ord. ...	125–130	...	...
90,000	10	June 12	15	14	South African	3–5	...	3
6,709,895	Stk.	Aug. 14	7	5	South Met. Ord.	125–130*	–2	127–129½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	133–138*	–2	135–137
850,000	,,	,,	20/–*g*	4	Do. 4 p.c. Irred. Pf.	98–102*	–1	100
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb. ...	76–79	...	79
1 000,000	,,	July 24	5	5	Do. 5 p.c. Red. Deb.	110–114	...	...
209,820	,,	Aug. 14	8½	8½	South Shields Con.	146–148*d* *	–3	...
1,543,795	,,	Aug. 14	6	6	South Suburban Ord. 5 p.c.	122–127*	–2	125
300,000	,,	,,	5	5	Do. 5 p.c. Pref.	111–116*	–2	...
300,000	,,	,,	—	4	Do. 4 p.c. Pref.	98–102*	–2½	...
868,837	,,	June 26	5	5	Do. 5 p.c. Deb.	118–123	...	121–122
100,000	,,	‡	—	—	Do. 4 p.c. Deb.	102–105	...	...
647,740	,,	Feb. 20	5	5	Southampt'n Ord. 5 p.c. max.	107–112	...	...
121,275	,,	June 26	4	4	Do. 4 p.c. Deb	99–104	...	...
350,000	,,	Mar. 6	9/–	5½	Swansea 5½ p.c. Red. Pref.	109–113	...	...
200,000	,,	June 26	6½	6½	Do. 6½ p.c. Red. Deb.	103–108	...	...
1,076,490	,,	Aug. 14	6⅔	6⅔	Tottenham and District Ord.	139–144*	–3	142–145
300,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	121–126*	–2	122½
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	108–113*	–2	110–113
199,005	,,	June 12	4	4	Do. 4 p.c. Deb. ...	96–101	...	100
85,701	,,	Apl. 3	6	6	Tuscan, Ltd., 6 p.c. Red. Db.	80–85	...	...
347,769	,,	Mar. 6	7	7	Uxbridge, &c., 5 p.ct. ...	140–145	...	...
88,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	110–115	...	...
1,322,220	,,	July 10	7	7	Wandsworth Consolidated	143–148	...	...
1,096,373	,,	,,	5	5	Do. 5 p.c. Pref.	113–118	...	114½
1,317,964	,,	June 26	5	5	Do. 5 p.c. Deb.	118–123	...	122
158,400	,,	Mar. 6	5	6A	Winchester W. & G. 5p.c. Con.	109–114	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. */*—The quotation is per £1 of stock. *g.*—For quarter. *h.*—Paid £3, including 10s. on account of back dividends. ‡ The interest due 1/7/33 was paid on that date. * Ex. div. † Paid free of income-tax. ‡ For year.

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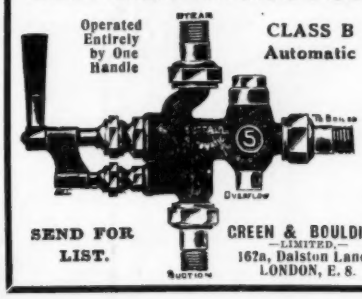

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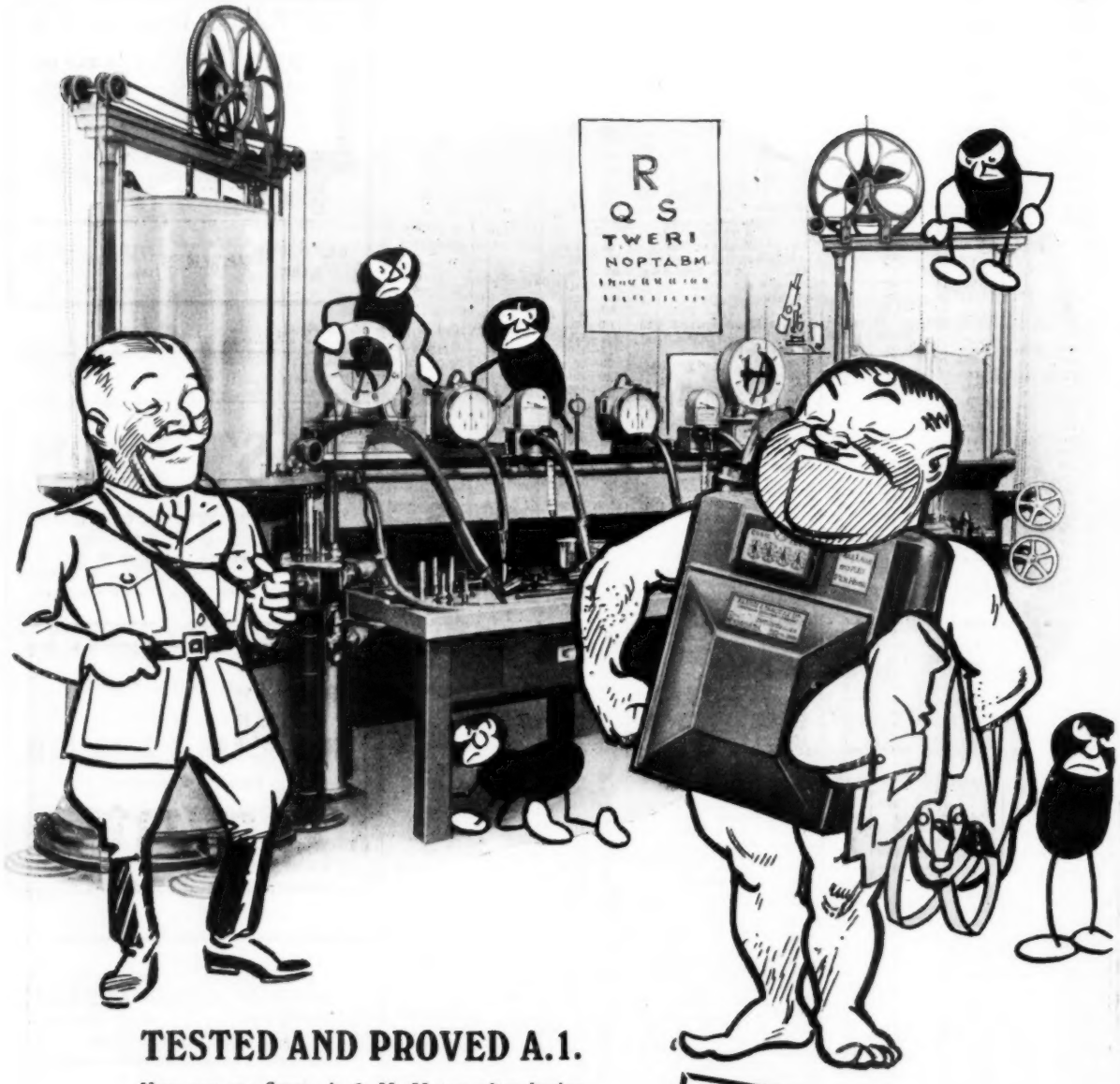

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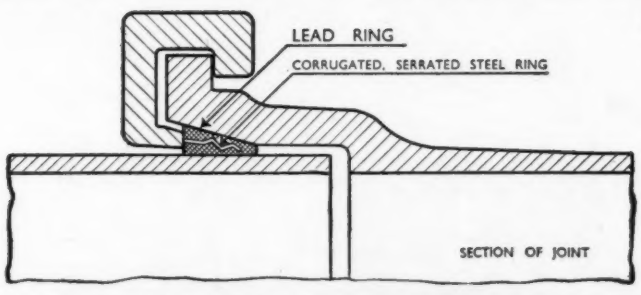
The STANTON Mechanical Lead Joint

(Patent applied for)



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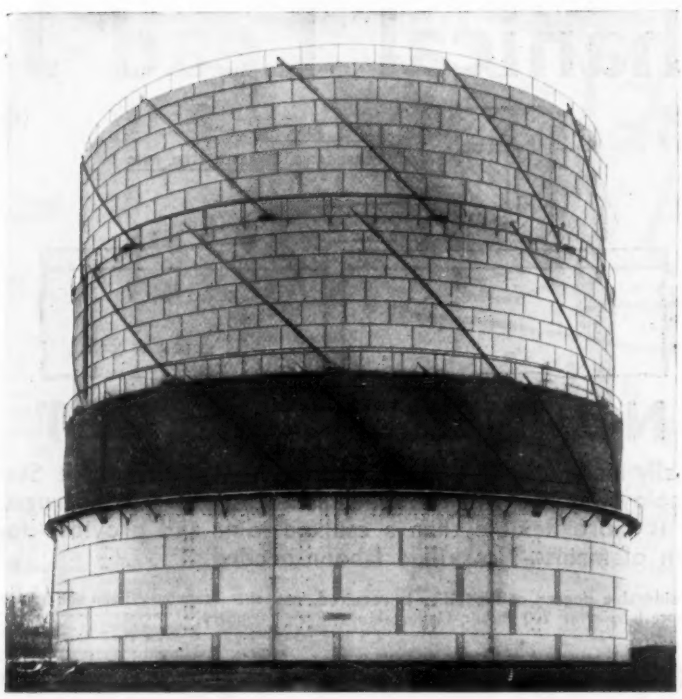

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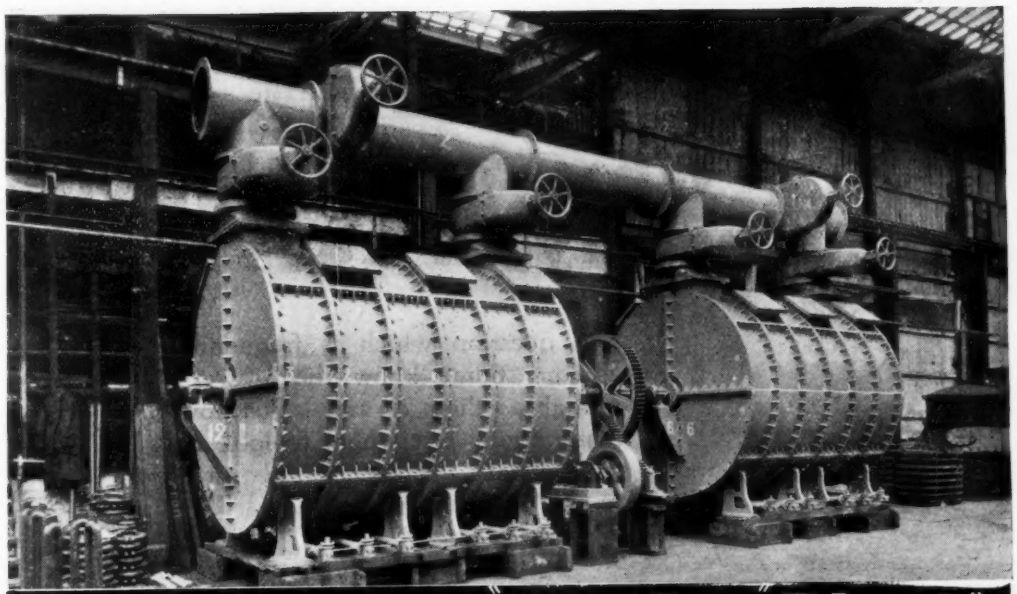

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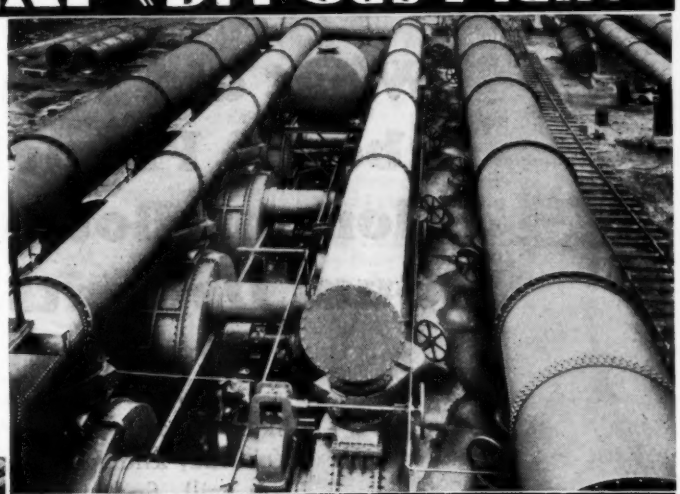

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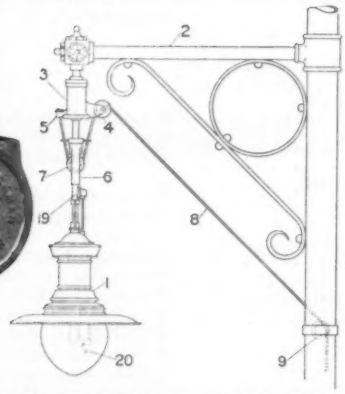

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